3 0700 00051952 9

3 0700 00051952 9

NTIA Special Publication 88-21

NTIA TELECOM 2000

Charting the Course for a New Century

National
Telecommunications and Information
Administration

U.S. Department of Commerce
Washington, D.C.

October 1988

NTIA Special Publication 88-21

HE
7775
U55
1988

NTIA TELECOM 2000

Charting The Course For A New Century

U.S. DEPARTMENT OF COMMERCE
C. William Verity, Secretary

Alfred C. Sikes, Assistant Secretary
for Communications and Information,
and Administrator, National Telecommunications
and Information Administration

John Shapleigh, Associate Administrator
of the National Telecommunications and
Information Administration for the Office
of Policy Analysis and Development,
Project Director, NTIA TELECOM 2000

October 1988

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, DC 20402

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for
Communications and Information
Washington, D.C. 20230

October 4, 1988

MESSAGE FROM THE ASSISTANT SECRETARY:

Telecommunications, to the average person or the average public official, means the telephone. If one presses for a broader definition, radio, television, and cable services might come to mind. In short, most Americans are readily familiar only with the services that have been around for decades.

Along similar lines, most believe that government involvement in telecommunications is principally to keep telephone rates in line, and to license and in some way oversee those who own television and radio stations.

This is not to say that Americans are unfamiliar with modern telecommunications technologies such as satellites. In fact, the Seoul Olympics has just showcased this marvelous development. And Tom Clancy has recently let us all in on the often exotic use of telecommunications in modern warfare. Yes, if pressed, most of us can begin to recall how ubiquitous and important advanced telecommunications technologies have become.

We are not as familiar, however, with the developing promises that telecommunications technologies and their skillful applications offer all of us each day. I would imagine few have had the opportunity to foresee dramatic improvements in education, health care, and family life due to telecommunications-delivered services. And, while some businessmen and women are beginning to use telecommunications to expand into international markets, few envision how the same services which transformed small local or regional businesses into national ones can be used worldwide.

If I was forced to use a single word to characterize our findings in this NTIA TELECOM 2000 report, it would be "transformation." Because, as telecommunications technologies have improved dramatically, as markets have been opened, and as rules have been reduced, man's ingenuity has begun to offer transforming applications of these technologies.

So while this report will be read for its findings on traditional telecommunications issues, I hope it will help open everyone's eyes to what is possible and how, acting wisely, we can make the possible into reality.

Sincerely,

Alfred C. Sikes

NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION

Alfred C. Sikes
Assistant Secretary for Communications and Information and Administrator, National Telecommunications and Information Administration

Charles G. Schott, III
Deputy Assistant Secretary for Communications and Information and Deputy Administrator, National Telecommunications and Information Administration

John C. Shapleigh
Associate Administrator for the Office of Policy Analysis and Development

Richard M. Firestone
Chief Counsel (Acting)

Richard D. Parlow
Associate Administrator for the Office of Spectrum Management

Kenneth Robinson
Senior Policy Adviser

R. T. Gregg
Associate Administrator for the Office of International Affairs

William F. Utlaut
Director, Institute for Telecommunications Sciences

Dennis R. Connors
Director, Office of Policy Coordination and Management

Charles M. Rush
Chief Scientist

James W. Spurlock
Director, Office of Congressional and Public Affairs

Teresa A. Lukach
Director, Office of Media Relations

NTIA TELECOM 2000 PROJECT

John C. Shapleigh
Director

PROJECT TEAM

Arthur J. Altenburg
J. Scott Bonney
Mark Bykowsky
Audrey E. Craner
Gregg Daffner
Daniel Davis
Alison A. Deeb
John Dern
John P. Fernández
Robert M. Frieden
Jack A. Gleason
Phyllis E. Hartsock
Joseph F. Kellagher
Harold G. Kimball
David H. Krech
Alfred M. Lee
Larry F. Martinez
Fredrick Matos
Robert J. Mayher
Helena Mitchell, Ph.D.
Terry Monroe
Val O'Day
Kathleen Rosenauer
Roger K. Salaman
Neal B. Seitz
Suzanne R. Settle
Tim C. Sloan
W. Russell Slye
Anita L. Wallgren
Thomas V. Wasilewski
Douglas Wiley

SUPPORT STAFF

Dolores Buckley
Don Druker
Linda Fykes
Ruby Gore
Denise Green
Dianne Greene
Harriet Jacobi
Mary Lipscomb
Margo Bruce
Janice Robinson
Mary Stewart
Sandra Stewart
Brenda Stone

ACKNOWLEDGEMENTS

NTIA TELECOM 2000 could not have been accomplished without the special efforts of many dedicated individuals.

John Shapleigh, NTIA Associate Administrator for the Office of Policy Analysis and Development and NTIA TELECOM 2000 Project Director, successfully led the project team and senior review group through hundreds of hours of research, countless discussions, drafts and redrafts, in a manner which generated and captured new insights and new ideas for telecommunication, television, cable television, radio and information policy toward the year 2000.

Dr. Jagdish N. Sheth, Ph. D., Brooker Distinguished Professor of Marketing at the University of Southern California, was a consultant to NTIA on this project and provided many valuable insights through his participation as co-chairman of several of the meetings with industry, government and academic leaders, through meetings with NTIA senior staff, through his written thoughts on forces of change for the next twenty years, and through his review of drafts of the report.

The Annenberg Washington Program in Communications Policy Studies of Northwestern University, founded through the generous support of Ambassador Walter H. Annenberg, provided valuable support for the meetings of industry, government, and academic leaders. Director Newton N. Minow and Associate Director Yvonne Zecca devoted extra efforts to making sure that the meetings were a success. Senior Fellows David Webster and Konnie Schaefer participated in several of the meetings and added immeasurably to the insights that were generated.

Charles Schott, Ken Robinson, Rick Firestone, R. T. Gregg, and Bill Utlaut formed the group of senior advisers that provided necessary feedback at all critical points in the project. Ken Robinson, in addition to helping draft the report, tirelessly performed the task of bringing all sections of Part One of the report together in the final stages. Phyllis Hartsock, Office of Chief Counsel, reviewed the final document end to end and provided numerous important suggestions and insights.

Jim Spurlock and Terri Lukach, Directors of the Offices of Congressional and Public Affairs, and Media Relations, respectively, added substantial quality to the final product through their immense efforts in the final weeks of the project.

Tim Sloan, Fred Lee, Gregg Daffner, and Fred Matos, in addition to their initial major contributions to the report, engaged in substantial extra efforts in the final stages of the project, resulting in a significantly better report.

Art Altenburg and Dan Davis inaugurated desktop publishing at NTIA with this report and made the process work under the incredible last minute pressures that develop in large projects of this kind.

Kathleen Rosenauer and Shawna Jones coordinated the four meetings of industry, government, and academic leaders in a manner that contributed immensely to their success.

Robert Pepper, FCC Office of Planning and Policy, observed all of the meetings of industry, government and academic leaders, and discussed facts and issues on numerous occasions with the project director and team members.

NTIA TELECOM 2000 MEETING PARTICIPANTS

NTIA gratefully acknowledges the following individuals, each of whom attended one of the NTIA TELECOM 2000 meetings and shared their vision of the year 2000 and their ideas on new telecommunications and information goals for the nation.

Mr. Gary H. Arlen
President
Arlen Communications, Inc.

Professor Jonathan Aronson
School of International Relations
University of Southern California

Mr. Fritz A. Attaway
Vice President and General Counsel
Motion Picture Asociation of America, Inc

Mr. Barry L. Babcock
Executive Vice President and CEO
Cencom Cable Associates

Dr. Lionel Baldwin
President
National Technological University

Mr. Ralph M. Baruch
Senior Fellow
Gannett Center for Media Studies
Columbia University

Mr. Robert Bennis
Senior Consultant
Westinghouse Communications Systems Center

Mr. Clement Bezold
Executive Director
Institute for Alternative Futures

Mr. Greg W. Blaine
Senior Vice President
Foote, Cone & Belding

Professor Nolan Bowie
Temple University
Department of Radio, TV & Film

Mr. William Bolger
Chairman
TCOM

Mr. Robert Bruce
Deveboise and Plimpton

Mr. Steve Brenner
USA Cable Network

Mr. Phil Campbell
Vice Chairman
Bell Atlantic

Mr. Frank Carr
Commissioner
Information Resources Management Service
General Services Administration

Mr. Joel Chaseman
President
Post-Newsweek Stations, Inc

Dr. T. Stephen Cheston
Senior Vice President of International Government Affairs
Geostar Corporation

Mr. Bruce L. Christensen
President
Public Broadcasting Service

Mr. Alan Cole-Ford
Senior Vice President
Planning and Development
Paramount Pictures

Mr. Robert Crandall
Senior Fellow
The Brookings Institute

Mr. Bruce Crockett
President
COMSAT World Systems Division

Mr. Arlen Diamond
General Manager
KMSU Radio

Mr. John A. Dimling
Senior Vice President
Nielsen Media Research

Mr. Jim Dowdle
President & CEO
Tribune Broadcasting

Mr. James Duncan
President
Duncan's American Radio

Mr. William L. Dunn
Executive Vice President
Dow Jones

Mr. Warren French
President
Shenadoah Telephone Co.

Mr. David Fuchs
CBS

Mr. Robert Galvin
Chairman of the Board
Motorola

Professor Oswald H. Ganley
Executive Director
Program on Information Resources Policy
Harvard University

Michael R. Gardner, Esq.
Akin, Gump, Strauss, Hauer and Feld

Ms. Debra Garza
Department of Justice

Honorable Henry Geller
Director of the Washington Center for Public Policy Research

Mr. Bruce Hagen
Commissioner, North Dakota Public Service Commission and President, National Association of Regulatory Utility Commissioners (NARUC)

Dr. Linda M. Harris
Senior Fellow
Public Health Service

Mr. Winston E. Himsworth
Managing Director
Shearson Lehman Hutton, Inc.

Mr. Henry Hockeimer
Assistant Director
United States Information Agency

Mr. Andrew T. Hospodor
Chairman & CEO
Aeronautical Radio, Inc.

Mr. Frank Johnson
Manager
Bell Laboratories

Dr. James E. Katz
Bell Communications Research

Ms. Kay Koplovitz
President
USA Cable Network

W. Terry Maguire
Senior Vice President
American Newspaper Publishers Association

Leonard H. Marks, Esq.
Cohn and Marks

Mr. Charles Marshall
Vice Chairman of the Board
AT&T

Mr. Clark McCleod
Chairman
Teleconnect

Mr. Ralph F. Meuter
Associate Vice President for Academic Affairs
California State University

Ms. Paula Newberg
Director of the Communications Policy Project
The Markle Foundation

Mr. Phillip Onstad
Director of Telecommunications Policy
Control Data Corporation

Mr. Norman J. Pattiz
President & Chairman of the Board
Westwood One

Mr. Marshall Phelps
Director, Governmental Programs
IBM Corporation

Honorable Ward L. Quaal
President
Ward L. Quaal Company

Mr. John Rieser
Vice President
Teleport Communications

Robert W. Ross, Esq.
CNN International Sales, Ltd

Professor Eugene V. Rostow
Former Under Secretary of State
Chairman, President's Task Force on Communications Policy (1968)

Mr. Phil Rubin
President
Rubin, Benarck & Associates, Inc

Mr. Robert Ryan
President
TCOM

Mr. Kalmann Schaefer
President
K. Schaefer & Associates

Dr. William F. Schreiber
Director of Advance Television Resource Program
Massachsetts Institute of Technology

Mr. Jacob Schwartz
Defense Advanced Research Project Agency

Mr. Frederic M. Seegal
Managing Director
Shearson Lehman Hutton, Inc.

Professor Jagdish N. Sheth, Ph. D.
Founder/Director, Center for Telecommunications Management and Brooker Professor of Marketing
Graduate School of Business Administration
University of Southern California

Professor Marvin Sirbu
Department of Engineering & Public Policy
Carnegie-Mellon University

Mr. Ralph Lee Smith
Publication Editor
NAHB National Research Center

Mr. Edwin B. Spievack
President
North American Telecommunications Association

Mr. Delbert Staley
Chairman & CEO
NYNEX Corporation

Mr. Sidney Topol
Chairman of the Board
Scientific Atlanta

Mr. Mike VanBuskirk
Vice President
TRW Information Systems Group

Mr. David Webster
Senior Fellow
Annenberg Washington Program

Mr. David Wenner
McKinsey & Company

Mr. Curtis White
Managing Partner
Starfire Communications Group Ltd

Ms. Margita White
President-Elect
Association of Maximum Service Telecasters, Inc.

Richard E. Wiley, Esq.
Senior Partner
Wiley, Rein and Fielding

Mr. Herbert P. Wilkins
President
Syndicated Communications, Inc.

Mr. Orville Wright
Vice Chairman of the Board
MCI Communications Corporation

TABLE OF CONTENTS

PART ONE - CRITICAL ISSUES IN TELECOMMUNICATIONS AND INFORMATION POLICY

Overview and Executive Summary 3

Summary of Conclusions and Recommendations 11

Chapter 1 - Twenty Years After the Rostow Report 21
Chapter 2 - Perspectives on the Next Twenty Years 55
Chapter 3 - The Telecommunications Infrastructure and "Universal Information Service" in the Year 2000 75
Chapter 4 - Ensuring Telecommunications and Information Services for Rural America 87
Chapter 5 - Delivery of Education, Health Care, and Other Critical Services Through Telecommunications 99
Chapter 6 - Maintaining America's Strength in Markets for Telecommunications and Information Services 115
Chapter 7 - Privacy, Information Flows, and the Protection of Intellectual Property in the Information Age 131
Chapter 8 - Television, Cable Television, and Radio Broadcasting in the Year 2000 149
Chapter 9 - International and Domestic Policymaking in the Year 2000 163

PART TWO - TELECOMMUNICATIONS AND INFORMATION SECTOR STUDIES

Executive Summary 187

I Local Networks 203
by Terry Monroe
II Long Distance Network Services 233
by Phyllis E. Hartsock
III Fiber Optics 259
by NTIA Staff
IV Space Communication and Information Systems 271
by NTIA Staff
V Land Mobile Radio Services 283
by Alfred Lee
VI Telecommunications Network and Customer Premises Equipment 305
by Joseph F. Kellagher

PART TWO (Continued)

VII Federal Government Use of Telecommunications 351
by W. Russell Slye

VIII Postal Services 385
by Roger K. Salaman

IX Information Services 409
by Fredrick Matos

X Electronic Banking and Financial Services 443
by John P. Fernández

XI Commercial Broadcast Television 483
by Timothy C. Sloan and David Krech

XII Commercial Radio Broadcasting 515
by Anita L. Wallgren

XIII Cable Television 539
by David Krech and NTIA Staff

XIV Public Broadcasting 573
by Helena Mitchell, Ph.D.

XV Film and Video Industries 587
by Anita L. Wallgren

XVI Consumer Electronics 609
by Thomas V. Wasilewski

XVII Communications and Information in Rural America 641
by Alison Deeb and John Dern

APPENDIX A: SPECTRUM MANAGEMENT 655

APPENDIX B: TELECOMMUNICATIONS STANDARDS 665

NTIA TELECOM 2000

Charting The Course For A New Century

PART ONE

Critical Issues in Telecommunications and Information Policy

Overview and Executive Summary

As America progresses toward the 21st Century, the horizon offers vistas of matchless promise, potential, and opportunities. New technologies, embodied in commercial innovation driven by the economic engine of competitive enterprise, can help satisfy our nation's critical needs in new ways. The resulting services can contribute to building a more creative, productive, and humane American society.

Today is the "Information Age," and telecommunications comprises its chief transportation system. Invisible highways of fiber optic cable and radio waves each second carry trillions of bits of information vital to the smooth functioning of our economy and society. Telecommunications is the electronic tie which can more closely bind our nation of communities together into an electronic "national neighborhood." Telecommunications affords individuals expanded access to information. In fundamental ways, it thus offers the individual greater freedom, and more social and economic power. By capitalizing on these electronic resources more effectively, America has an opportunity to become more competitive while enriching the overall quality of our national life.

The "electronic tools" of the information age -- personal and business computers and videocassette recorders, for example -- already have transformed most of our lives. They offer yet untapped potential to expand personal opportunities, to foster creativity, and hence contribute to individual freedom, more, perhaps than followed the advent of the automobile less than a century ago. Appreciating these opportunities, and capitalizing upon them, however, will require greater understanding and a stronger national communications policy consensus.

Origins of NTIA TELECOM 2000

Armed with understanding of the challenges and opportunities presented, the National Telecommunications and Information Administration (NTIA) commenced a comprehensive assessment of this nation's communications and information sectors just over a year ago. Our basic goal was to identify national communications and information priorities, both for today as well as the balance of the century.

NTIA TELECOM 2000: Charting the Course for a New Century represents the first comprehensive review of the communications and information sectors undertaken by the Executive branch in some 20 years. In 1968, a Presidential Task Force under the leadership of Under Secretary of State Eugene Rostow, was commissioned by President Lyndon Johnson to undertake "a comprehensive study of communications policy." The Rostow Task Force's recommendations formed the basis for America's ensuing "Open Skies" policy (which allowed a competitive domestic satellite communications system to develop) and other policy advances. Developed in the course of the last year of the Johnson Presidency, the Task Force's recommendations were substantially implemented in the early years of the Nixon Administration, representing a tribute both to the quality of work and our traditional, bipartisan recognition that sound national telecommunications policies are important.

It is striking to assess how much has transpired in those two decades since the Rostow Task Force completed its deliberations. The communications world of 1968 was pre-microelectronics and pre-fiber optics, pre-microcomputer and pre-VCR. It antedated the Bell System breakup and the recent substantial expansion of the abundance of American radio and television stations and service. In 1968, AM was the dominant radio medium. FM radio, color television, and the audio cassette recorder were only just emerging. It was an environment where cable television passed few homes and chiefly relayed broadcast signals. In short, it was an era in telecommunications history far different from today's.

Equally striking is just how new the entire telecommunications field is. Little more than 100 years separate us from the basic scientific discoveries of Bell and Marconi which fueled early development of telecommunications. The Communications Act of 1934, the fundamental -- and still basically governing -- policy framework for this technology is just over half as old. The 12 years remaining before the turn of the century thus represent a significant fraction of this technology's lifetime. But as the pace of progress quickens, more communications and information changes may occur more rapidly over the coming decade than we have experienced before.

The Challenges for the Information Age

The telecommunications and information industries have advanced from a modest role in support of an industrial age economy to that of essential infrastructure for the information age. Industry issues confronting 21st Century America, accordingly, are matters of major importance and should rank high on the national policy agenda.

Exponential technological and commercial growth today characterizes telecommunications. Our telecommunications world in 1968 was characterized by much certainty with but some change. From now through the year 2000, that world will experience high rates of change with only some certainty.

This critical sector has also become increasingly pivotal to maintaining the robustness of our economy and fostering the vitality of our society. The issues tackled here are thus squarely on our nation's critical growth path. Their implications must thus be addressed from a broad national interest perspective. Resolution of important policy choices should not be relegated to the day-to-day interplay of sometimes parochial, interested parties.

Significantly, many of this nation's most basic telecommunications goals have largely been met. Some, such as the continuing bipartisan commitment to maintaining basic universal telephone service at affordable rates, are fundamental. They should not be altered. New additional goals, however, need to be considered and assessed.

There is no shortage of challenges. An overriding issue is how they should be addressed, what our new goals should be, and how best we can work together as a nation to achieve them.

The following represent crucial information age challenges facing our country:

o Competitive Strength. It is critical that this nation's telecommunications and information resources be made more fully available, especially to buttress the strength of the American economy. With the globalization of most markets, improving the quality and flexibility of any nation's communications and information infrastructure has become a competitive imperative. The competitiveness of U.S. manufacturers in world markets will increasingly hinge on effective use of computer-communications networks aimed at efficiently coordinating all stages and factors of production. Whether U.S. companies enjoy efficient access to such networks, both here and overseas, has direct bearing on our long-run economic future, and the quality of life our economy will support and deliver.

The primary goal of universal voice telephone service has been largely achieved. We now face the challenge of further unlocking and enhancing all of our national telephone resources. Achieving universal availability of more innovative services will be difficult. Traditional concerns with cross-subsidies and regulation of monopoly will have to be reconciled with the need to realize the benefits of synergy within and among our telecommunications and information companies. But the gains, if we succeed, are substantial.

o International Trade. Telecommunications technology in the 21st Century will function as the backbone and nervous system of international commerce. Domestically, long distance communications have dramatically increased in speed, volume, and variety while simultaneously dropping substantially in cost. International communications users are entitled to comparable gains. Trade in telecommunications products and services will also constitute an increasingly larger share of world commerce.

The Bell System breakup, combined with other developments, unleashed major product and service changes. With these changes, substantial communications trade concerns arose. An $817 million trade surplus in 1981, for example, deteriorated to a $2.5 billion deficit in 1987 in telephone and telegraph equipment alone. In electronics-based products, America went from a $6.04 billion surplus in 1981, to a $15.01 billion deficit in 1986. By comparison, the 1986 U.S.-Japan automobile deficit was just $23 billion, and had taken nearly a decade to rise to such levels. Here, in a critical high-tech "sunrise" sector, a deficit problem nearly three-fourths as big as the "car problem" has materialized, and in but half the time. As recently passed communications trade legislation demonstrates, slowing the annual rate of trade deficit growth and, hopefully, reversing it altogether is a major priority.

o **Education**. Education is key to effective development of America's human resources, and communications can make a significant difference. How widely skills and knowledge are disseminated will be critical. Though America's past education achievements are substantial, many also believe we can and must do better. Public education need not be a "monopoly with a 50 percent rejection rate," as one expert recently commented. Developments including satellites, cable television, videocassette recorders, and capitalizing on the combined talents of our educators and public broadcasters offer promising means of strengthening public education. These developments will place the power to distribute knowledge into more and more hands, and of equal importance, give more and more people access to a better quality education.

Pressures on education budgets are building. As an aging population competes for resources and birthrates stay low, the pace of technology in key sectors is generating new demands -- for post-high school and post-graduate education and training. Quality education has never been more important. But the potential of telecommunications in this area has not yet been significantly tapped. Innovative use of our communications and information assets is critical if opportunities in education are to be realized.

o **Citizenship, the Family, and the Individual**. Telecommunications developments offer new ways for Americans and their elected officials to participate in the political process. The C-Span cable television network, for example, brings this nation's basic legislative process home to the people. It de-mystifies government for millions. Telecommunications also affords new means by which news and information -- the raw material of the marketplace of ideas -- can be disseminated. Expanded international communications and information networks and services have clear potential to contribute to greater peace and understanding.

At home, telecommunications and information services have demonstrated potential to strengthen the family by reducing certain pressures and thereby opening up new opportunities. Electronic banking, shopping, telecommuting, and a diversity of further electronic choices will reduce demands on working mothers, and expand the time they have available to spend with spouses, friends, and children. These new services will afford women especially more opportunities.

o **Entertainment and Information**. Communications technologies offer Americans a tool in their pursuit of happiness. The diversity of electronic news, entertainment, and information offerings has never been greater than it is today, nor has public demand ever been higher. No single communications service commands more popularity internationally than television. Nor does any other communications service so affect our world.

By virtue of television, young people worldwide often more closely resemble one another than their parents. In emerging nations, people watch satellite-relayed programs and trade videocassettes. Millions look to television to provide shared national experiences, plus a window to the world outside. Entertainment and information programming provides food for thought; and television helps feed the world. By lowering government barriers and furthering the free exchange of ideas, television affords great opportunities to foster and support increased mutual understanding.

o Finance. Money has become a telecommunications concept. The financial community has led in applying innovative, telecommunications-based solutions. Today, six out of every seven dollars are transferred electronically. Tomorrow, electronic banking and related offerings may achieve even greater predominance.

o Science and technology. America's technological prowess has long proven our competitive edge. Harnessing the power of communications and information services with the talents of our research community can contribute to a better, more abundant tomorrow. Whether in medicine, physics, or engineering, these electronic tools need to be more fully available. Space represents "the infinite frontier" and telecommunications was the first business in space; it will be essential to all business activity conducted there.

The Role of Government

Rapid change requires a continuing evaluation of government's proper telecommunications and information role. Yesterday's institutional arrangements have lost and will continue to lose relevance in the face of technical and commercial developments. Domestically, arrangements dating from 1934 and passage of the Communications Act may handicap the introduction of technology, as occurred with cellular mobile telephone and cable television service. Today, a judicial regulatory bottleneck is affecting the wider and more effective distribution of information age benefits. Yet internationally, Government has inescapable responsibilities, and must be better organized to fulfill them.

We face a promising future filled with dazzling new technologies and applications. But our achievement of maximum benefit from this electronic cornucopia may be compromised by unnecessary or ineffective government actions. Domestic regulatory costs, which were bad enough when America enjoyed unchallenged economic leadership, have clear potential to impose unacceptable burdens as we strive to maintain our national competitiveness. Internationally, the time when we could afford the current dispersion of Government responsibilities is gone.

How we tackle such difficulties will be a major challenge as we progress toward the 21st Century. Here, we have sought objectively to assemble the objective facts and candidly present critical choices. We also advance recommended solutions. Not all, of course, will agree. But all should concur that it is important for this nation collectively to address these issues and reach consensus solutions which will better satisfy the country's needs.

Project Description

Once conceived, NTIA TELECOM 2000 commenced with concentrated fact finding. NTIA staff undertook studies of key communications and information sectors. These are published as Part II of this report, together with appendices on the spectrum allocation and standards setting processes. Based on these and other studies, discussions were conducted with recognized telecommunications and information industry, government, and academic leaders.

We sought insights into four broad areas: (l) telephone and information services; (2) mass media offerings; (3) international telecommunications; and (4) the delivery of critical human services. Visions of the telecommunications future were projected and future goals and objectives for America identified. Many insights reflected herein stem from the keen observations of those individuals acknowledged at the outset of this report. We are fortunate so many contributed to this effort.

Trends Affecting Telecommunications

Some initial observations are in order. First, most of trends in this field were found to be generally positive. Telecommunications markets, both domestic and international, are growing substantially. Customer choice is expanding and prices are generally declining. While unwarranted judicial and legislative limits on competition persist, domestically there has been an overall reduction in government controls and bipartisan support for most such actions. Where regulation is still needed, moreover, regulators have typically emphasized maximum reliance on marketplace solutions.

Second, most negative trends are international in character. Telecommunications trade trends are strongly negative. Liberalization notwithstanding, foreign governments continue to play an important role, and the United States needs to strengthen its ability organizationally to respond more effectively.

Third, however, we found disturbing problems that bear on our ability as a country collectively to address and resolve communications problems. Interest groups have become more adept in blocking forward progress. Multiple decisionmaking forums and other undesirable factors are, as discussed further, contributing to policy gridlock.

The fundamental interests of all parties are more alike than different. All seek to ensure the American public enjoys the widest possible choice at the lowest possible price, while our economy and society retain their strength and vibrancy. But differences on the best means of achieving these shared goals remain -- and at precisely that juncture when the need for all Americans to come together and work constructively in the national interest is growing.

We are all "in the same boat," as one meeting participant put it. Our international rivals are well-organized and pursuing coherent policies to further their national interest. Here as in other fields, needless faction and divisiveness among Americans is part of the problem, not part of the solution.

Telecommunications Goals for the 21st Century

Based on our investigations, a number of telecommunications and information goals for America as it progresses into the 21st Century have been identified. These include:

- o Maximum Telecommunications Contribution. It is essential we obtain the maximum contribution from our telecommunications and information resources to accomplish the many goals we seek as a nation.

- o Infrastructure. Analogies exist between our modern telecommunications infrastructure and the transportation systems of the industrial age, from railroads and canals to our interstate highway system. An adequate, indeed, superior telecommunications infrastructure must be deployed to deliver the full benefits of the information age.

- o Universal Services. Our national commitment to universal access to telephone, radio, and television remains sound. But market forces should be permitted to ensure universal access to information services and other innovative services as they become more available.

- o Rural America. Our nation has always been committed to making communications technologies, from postal to telephone to radio and television, available in rural areas. We must maintain this commitment and consider how modern telecommunications and information technologies and systems can fuel rural economic and cultural growth.

- o Delivery of Critical Education, Health Care and Other Critical Services. The ability of telecommunications and information technologies and systems to raise the quality and lower the price of educational, health care, and other critical services has only begun to be tapped. Leaders in each of these areas must begin or renew their efforts to find ways to improve the delivery of these critical services through telecommunications and information applications.

- o Radio Spectrum. Obtaining maximum use of the radio spectrum is critical. Substantial improvements in spectrum allocation and management can and should be achieved.

- o Free Speech. Progress should continue to be made toward attaining First Amendment parity among electronic and print media. Inequality potentially handicaps some media, and thus affects the quality of choice offered the public. Government content authority also tempts government to apply harmful pressures.

- o Effective Privacy, Security and Intellectual Property Rights. Individual privacy and security of information must be ensured. Intellectual property rights sufficient to stimulate creativity and innovation in all sectors are critical.

- **International Communications**. More should be done effectively to promote American interests in competitive international communications and information markets. This is among the fastest growing communications sectors. It commands substantial significance for all aspects of American life.

- **Diversity and Choice**. Maximum possible diversity and choice for our citizens in all communications services and media should continue to be fostered. The ability to choose constitutes a major component of individual freedom.

- **Competition**. Our fundamental national economic policy favoring competitive solutions is increasingly relevant. Effectively competitive, unregulated communications and information markets have delivered substantial benefits to date. They are the best guarantee that the public will have the communications and information facilities and services they want and need.

Conclusion

Communications has been critically important since the earliest times. One reason for building the Great Wall of China, for example, was to enable important information to be communicated faster than had previously been possible. History provides many other examples.

Telecommunications technology, on the other hand, is less than a century old and yet it represents a new and radically improved capacity to address this ancient and important human need. Significantly, telecommunications technology has become a prime engine for much of our growth and prosperity in the modern day. Its advances have brought with it significant policy issues, however. How well we address and resolve these challenges will have a significant impact on how we will live as a nation and as a people.

Summary of Conclusions and Recommendations

CHAPTER ONE: TWENTY YEARS AFTER THE ROSTOW REPORT

Conclusions

- Continuity with change has become change with continuity. Technology, demographics, competition, and Government action have speeded change in telecommunications markets. Consequently, traditional regulation and its assumptions have become increasingly obsolete.

- Most Government forecasts have underestimated the pace of growth and change. In instance after instance, Federal forecasts have assumed slower development, and more continuity, than experience over the past decades has shown.

- Competition builds markets; it does not erode them. The more competitive a given geographic, product, or national market, the faster it seems to grow. Competition thus seems key to sector development, and maintaining relative national parity.

- Increasing faction, coupled with multiple policy authorities, may hobble procompetitive growth. The active, ad hoc involvement of the courts and Congress may heighten uncertainties and impede otherwise desirable developments.

CHAPTER TWO: PERSPECTIVES ON THE NEXT TWENTY YEARS

Conclusions

- Faster growth on the part of less-regulated and unregulated sectors will mean less and less of total communications market economic activity will come within the direct control of traditional regulation.

- Developments will diminish chances of "market failure". Decreasing costs and increasing capabilities will reduce the need for Government intervention to compensate for "market failure."

- Increasingly sophisticated business and residential markets will demand more and different options. Telecommunications and information services reliance on the part of U.S. business and industry will continue to swell, and the advent of widespread computer literacy, plus demographic changes, will drive individual demand as well.

- Telecommunications and information services will become even more important to our international trade and competitiveness, and market-based solutions are most likely to ensure the strength and robustness of this critical high-technology sector.

CHAPTER THREE: THE TELECOMMUNICATIONS INFRASTRUCTURE AND "UNIVERSAL INFORMATION SERVICE" IN THE YEAR 2000

Conclusions

- Telecommunications policy has achieved universal basic voice telephone service. Efforts should continue to assure this important accomplishment is not jeopardized.

- A vast array of new telecommunications and information services will become available by the year 2000, many of which will be used by most people in day-to-day life.

- Government-imposed legislative, regulatory, and judicial barriers continue to limit competition and innovation in local telephone service, cable television service, and Bell operating company information services.

- Regulators have begun to move from purely internal subsidies to more targeted subsidies, such as lifeline service, "Link Up America," and universal service funds.

- Present regulatory pricing policies delay modernization of the country's telecommunications infrastructure, jeopardize the affordability of basic service, deny customers access to new and innovative services, and potentially compromise the competitiveness of U.S.-based firms as well.

- Rate of return regulation is an outmoded "cost plus" scheme which has produced higher costs, fewer incentives for efficiencies, and less innovation than more modern regulatory approaches.

- In a fully competitive environment, new services could lead to the formation of an electronic "national neighborhood" or even "international neighborhood" which bridges geographic, economic, and social barriers.

Recommendations

- Policies should be adopted which will make it possible to achieve access to "universal information service" whereby ordinary small business and residential telephone subscribers have full access to the wealth of information and other innovative services upon which our success as an economy and society is coming to depend.
- More than this, we must focus on the creation of the world's best telecommunications and information infrastructure, which could lead to the availability of "video dial tone" and other innovative services.

- More reliance on competitive marketplace forces and incentives is needed, and barriers to competition, including in local exchange and cable services, should be removed.

- Rates for competitive services must be economically deregulated and rates for noncompetitive services moved toward cost, so that the marketplace will make the investments necessary to develop an advanced telecommunications and information infrastructure.

- Policies for assistance to low-income users should be focused, in order to target assistance directly to those who otherwise might be precluded. Market failure, moreover, should not be assumed in the case of additional communications offerings. If it materializes, which is unlikely, steps can then be taken to ensure access to new services deemed vital.

CHAPTER FOUR: ENSURING TELECOMMUNICATIONS AND INFORMATION SERVICES FOR RURAL AMERICA

Conclusions

- By the year 2000, converging and emerging telecommunications, information and video technologies could present rural America with a far greater degree of choice in the number and types of services available and make it possible for rural America to be a part of the electronic "national neighborhood."

- New technologies such as digital radio telephones, television receive-only satellite dishes, very small aperture (VSAT) satellite systems, and more, are already in use in some parts of rural America.

- A less favorable scenario could occur if market forces are not allowed to or otherwise do not drive deployment of communications technologies at the same rate in rural as in urban areas, thus producing a widening gap in the communications and information services available.

- Congress, the FCC, and Executive branch have always recognized the special needs of rural America and should continue to do so.

Recommendations

- Ensure that policies take fully into account the different circumstances prevailing in rural and urban America.

- Promote maximum competition generally, but assess each competitive policy as to its potential to be counterproductive in sparsely populated areas where the economic base may not be sufficient to support a single firm, much less competing firms.

- Continue existing support programs as needed and desirable, to ease the transition to a more competitive communications environment overall, without placing a disproportionate cost burden on rural residents.

- Pursue policies which encourage telephone companies, including the Bell companies, to offer new services in rural areas.

- Efforts to attract industry to rural areas should include consideration of enhancing the telecommunications and information facilities and services available through links with fiber optic or microwave networks, or teleports, for example.

- Encourage telecommunications companies and organizations to assist in economic development, and to provide training and technical assistance to small independent telephone companies.

CHAPTER FIVE: DELIVERY OF EDUCATION, HEALTH CARE, GOVERNMENTAL, AND OTHER SERVICES THROUGH TELECOMMUNICATIONS

Conclusions

- The telecommunications and information infrastructure is increasingly an essential, integral part of business and societal life, and no longer merely a helpful support function.

- A well-developed telecommunications and information infra-structure could provide crucial, pervasive, day-in, day-out benefits in the personal and working lives of all citizens: it can improve the education system, facilitate health care, provide small business opportunities, provide for safety and security, strengthen the family, and encourage broader participation in the life of the community.

- An advanced infrastructure will enable vendors to create the services and specific applications of services to the various sectors that will allow for U.S. industry to gain a competitive edge through improved productivity, improved quality, and faster innovation in the work place.

- Users as well as providers have participated in the development of the U.S. telecommunications and information infrastructure, particularly the education community. Such involvement has already produced increasing public investment in the infrastructure. The Public Television Facilities Program of NTIA has helped fund, for example, the satellite-based National Technological University (NTU) and similar initiatives. State universities have funded microwave and satellite educational networks. The Federal government itself owns and operates extensive networks used by its agencies and for delivery of agency services. Hospitals, schools, and libraries throughout America have created new portions of the infrastructure as well.

Recommendations

- Just as the "open skies" policy of the 1970s increased satellite telecommunications competition, improving quality and reducing costs, and thereby enhancing the electronic fabric of our economic and social life, similar "open entry" for local alternative network providers, cable television service, direct broadcast satellite, teleports, multichannel multipoint distribution systems, and technologies not yet known will enhance the development of a vastly improved infrastructure.

- The role of regulation should be de-emphasized and instead the focus should be on the critical need for enhancement of the telecommunication and information infrastructure.

- Leaders in our educational, health care, employment training, security, and other industries must assess and reassess their efforts to deliver faster, higher quality, and less expensive services over the telecommunications and information infrastructure, and continually consider how to coordinate their planning with providers in order to facilitate infrastructure improvement at the optimum rate.

CHAPTER SIX: MAINTAINING AMERICA'S STRENGTH IN MARKETS FOR TELECOMMUNICATIONS AND INFORMATION AND INFORMATION SERVICES

Conclusions

- America's relative economic, political, and cultural strength in the year 2000 will be significantly affected by the vitality of its telecommunications and information sectors.

- Today, almost for the first time in its history, the United States faces strong challenges to its technical and commercial leadership in telecommunications.

- Increasing global telecommunications interdependence and movement in other countries toward more competition are currently juxtaposed with national industrial policies which seek to forestall foreign access to domestic markets while targeting foreign markets for subsidized entry.

- Issues concerning communications infrastructure development, standards development, research and development, and spectrum resource allocation have a direct effect on our international trade balance in telecommunications equipment and services.

- There is a need for substantially greater U.S. government participation in international telecommunications and information arenas, including international radio spectrum regulation, associated multilateral discussions regarding satellite orbital use, standards development, communications trade policy, and foreign market access.

- The view of international telecommunications in the next century is affected by what we do now to forestall a deteriorating trade posture. Existing trends cannot continue, lest we lose international technological and policy leadership. It is essential that telecommunications become a part of the national agenda, not simply a subject for interest group maneuvering.

Recommendations

- Affected industries and government should commit sufficient personnel and other resources to develop a steady, expert, and persistent presence in international forums that address resource allocation, standards setting, regulatory, and trade issues. To do otherwise is to allow the international telecommunications marketplace to tilt increasingly to foreign players.

- The United States must build on recent successes to achieve a better understanding of when to emphasize which approach and at what forums. Unilateral actions, such as the AT&T divestiture did not make the international telecommunications marketplace more accessible for U.S. manufacturers, even as the U.S. market opened to greater penetration by foreign manufacturers. On the other hand, our initiatives to promote facility and service competition helped our nation while encouraging other nations to privatize their telecommunications industry or to permit some facility and service competition.

- Additional bilateral actions involving the United States and a few progressively minded nations can serve as the foundations for future multilateral agreements. What the United States and the United Kingdom agree to regarding international value-added networks, for example, will have a substantial impact on what other nations can accept in global forums such as the ITU-sponsored World Administrative Conference on Telegraph and Telephone.

CHAPTER SEVEN: PRIVACY, INFORMATION FLOWS, AND THE PROTECTION OF INTELLECTUAL PROPERTY IN THE INFORMATION AGE

Conclusions

- By the year 2000, new telecommunications and information technologies and services will likely have consequences that could significantly affect traditional concepts of privacy, information flows and the ownership and control of intellectual property.

- The vast amount of information handled by telecommunications and computer networks, coupled with the ease of access and speed with which volumes of data can be copied, altered, or erased, heighten the importance of information policy issues as we face the 21st Century.

- Today, we may be aware only of a small part of the potential risks involved in global, instantaneous, high capacity networks combining voice and data transmissions with computer access and control.

- In pursuing the goal of adequate privacy and security safeguards in the 21st Century, there likely will arise both technical and marketplace solutions to problems of unwanted use and misuse of information.

- Congress and the public have proven capable of recognizing and solving privacy problems in a targeted way as new industries and services have developed.

- With respect to international flows of information, other countries have policies different from the U.S. and resulting global trade can be adversely affected by assymetrical information policies.

- If intellectual property is not vigorously protected, creative works will be discouraged and the incentives to make more will be reduced. In contrast, through strong intellectual property protections, there will be an expanding pool of creators and new works.

- Over the past thirty years, copyrighted intellectual property has contributed an increasing percentage of the Gross National Product.

- Both domestically and abroad, public understanding of the principles underlying intellectual property rights is losing ground to a widespread view that individuals have a right to reproduce works, particularly if it is easy and cheap to do so.

- Beyond our borders, additional complications arise due to the uneven and even nonexistent legal recognition of intellectual property, and laws are often unenforced or have not been amended to reflect technological changes.

Recommendations

- Individuals need to become sufficiently informed about the capabilities of telecommunications to make choices that reflect their level of concern about privacy.

- Government must remain prepared, if necessary, to act quickly and effectively to protect personal privacy and ensure information security. Specific legislative and judicial remedies should continue to be devised as warranted, rather than developing omnibus legislation.

- The United States should in all bilateral and multilateral relationships continue to promote the unrestricted flow of information (with internationally agreed upon exceptions) across national borders.

- Individuals and governments must recognize, and act in accord with the recognition, that adequate intellectual property laws and enforcement of those laws are necessary to ensure an expanding pool of creators and new works.

- The U.S. Government must adopt and enforce intellectual property laws domestically and must continue to work for stronger protection and enforcement by other countries to maintain a strong U.S. trade position and to promote the creation and dissemination of literary, artistic, musical, and other information-based works worldwide.

CHAPTER EIGHT: TELEVISION, CABLE TELEVISION, AND RADIO BROADCASTING IN THE YEAR 2000

Conclusions

- Americans in the 21st Century likely will enjoy a dazzling array of electronic media and programming sources far exceeding that which is available today.

- Broadcast television may experience further structural changes, and may prove less profitable than at the present time, but there is no substantial reason to anticipate its economic demise.

- Radio, which has successfully weathered a number of fundamental commercial changes in its long history, should also continue to remain a strong sector.

- Cable television will become increasingly important as remaining cities are wired and as more and more households subscribe.

- Direct broadcast satellite and multichannel multipoint distribution systems will supplement existing video services in some areas.

- Increasing levels of broadband capacity, generally through fiber optic systems in the local telephone and cable networks, may make possible the commercial provisioning of a "video dial tone" which could give subscribers access on demand to a virtually unlimited library of video, audio and data services.

- Such a "video dial tone" could contribute to the formation of an electronic "national neighborhood" that through shared experiences and intercommunications, helps bring the American people and our communities closer together.

- The "scarcity" of broadcast frequencies, which formed the rationale for extensive broadcast content and other regulation, no longer exists.

- The content-based portions of FCC rules now apply to a rapidly decreasing amount of the video and audio programming received by the public. They apply to television and radio broadcasters, not to competing media, threaten to deter investment, distort market performance and development, and may also be unconstitutional.

Recommendations

- Congress and the FCC should immediately take steps to remove most remaining content-based rules governing radio broadcasting, and modify licensing procedures, in order to gain experience to determine what degree of television deregulation could best promote the public interest. If legislation is deemed necessary, it should seek to foster maximum competition by, among other things, providing for indeterminate radio licenses, and ten-year licenses for television.

- The broadcast industry should, in the meantime, develop self-regulation as have other media industries.

CHAPTER NINE: INTERNATIONAL AND DOMESTIC POLICYMAKING IN THE YEAR 2000

Conclusions

- International, and sometimes domestic, telecommunications and information policy under the current organizational structure is often reactive and skewed toward achieving short term objectives, focusing too much on maintaining the status quo, despite the influx of technological innovation and marketplace pressures.

- The current structure invites forum shopping, and "divide and conquer" strategies by special interests, including foreign-based, and makes leadership and Congressional oversight difficult.

- A lead telecommunications and information policy agency must have a cross-disciplinary depth of skills encompassing economics, engineering, political science, and communications and intellectual property law, with both domestic and international dimensions.

- The FCC's direct supervisory powers over the overall telecommunications and information industries has steadily diminished due to deregulation of mass media and common carrier markets, increasing market shares of completely unregulated or less regulated industries, and FCC decisions to not regulate certain businesses.

- Despite Congressional and Executive branch calls for improvements over many decades, the structure for telecommunications and information policymaking remains part of the problem, not the solution to the nation's telecommunications and information policy challenges.

- It has been suggested at different times that a central telecommunications and information policymaking agency be located in the Department of

Commerce, the Executive Office as a Special Adviser or Office of Telecommunication Policy, or even as a separate department, such as was created for transportation policy.

Recommendations

- The Executive branch should have the authority to establish policy, while the FCC should remain the agency for implementation of policy.
- Alternatively, the Executive could have the ability to disapprove FCC action, at least in matters of overriding national security, foreign policy, international trade, or economic policy.
- The next Administration should promptly address these issues and consider a more centralized policymaking structure for the Executive branch, with at least a clarification of Executive Order 12046.

1

Twenty Years After The Rostow Report

Two decades have elapsed since the Rostow Communications Policy Task Force's report was completed. During that time, major changes have affected virtually every part of the U.S. communications and information business.

This chapter examines those changes and why they occurred. It reviews both accomplishments as well as shortcomings of U.S. communications policymaking. And, it endeavors to provide sufficient insight into past American experience to facilitate the development of sound policies well suited for tomorrow.

Structurally, this chapter, first, briefly reviews the communications environment surrounding the Rostow Task Force's deliberations. Second, principal changes are highlighted and their implications discussed. Technical, commercial, demographic, and regulatory reasons for those changes are surveyed and assessed. Third, developments in foreign countries and their consequences are mentioned. Finally, general observations based on the past decades' experience are set forth.

The Status Quo Ante and Today

Generalizations inherently are risky. Twenty years ago, however, most facets of the U.S. domestic and international communications business were appreciably different. Markets and submarkets were characterized by a limited number of large, commercially dominant players. Technological stability, institutionalized barriers to new entry, relatively rigid government regulation, and scant price and service competition prevailed.

Communications Common Carriers

Domestically, the communications common carrier telephone business was overwhelmingly dominated by the vertically integrated Bell System. Telephone companies supplied chiefly basic voice communications. Familiar, traditional technologies were employed. Typically, firms were self-contained economic entities; AT&T, GTE, and United Telephone, for example, were vertically integrated into equipment manufacturing. Imports accounted for a small part of the U.S. telephone equipment market. No domestic telephone company was significantly involved in selling its products abroad. Telephone operations were extensively regulated economically, both at the state and Federal levels. Technologically and commercially, the telephone and computer-data processing industries were largely discrete. The Federal Communications Commission (FCC) had sanctioned limited competition in customer-premises equipment and interstate long-distance services, but most geographic and product markets remained legally or practicably closed to competition.

Internationally, communications service was provided chiefly by AT&T and a handful of international record carriers (i.e., telegraph and telex providers). The Communications Satellite Corporation (Comsat), established pursuant to 1962 legislation, functioned exclusively as an international "carrier's carrier." Half of Comsat's stock was owned by established terrestrial carriers; AT&T alone held about one-quarter and an AT&T official participated actively on Comsat's board. International carriers were rigidly price regulated, and certificated on a route-by-route, circuit-by-circuit, service-by-service basis. An antitrust immunized cartel, the International Quota Bureau, apportioned certain traffic among international record carriers. The International Telecommunications Satellite Organization (INTELSAT) had not yet become truly independent of Comsat. U.S. interests and influence were predominant and unchallenged.

Broadcasting and Other Electronic Media

In broadcasting, three national television networks -- two well-established and a third, seeking to consolidate its position -- overwhelmingly dominated that pivotal business. The most popular television programs, incidentally, were Marcus Welby, M.D. and The Flip Wilson Show.

Network news, funded to the extent of some $120 million annually -- equivalent to $500 million in today's currency --essentially was the nation's newspaper. As today, television news constituted the single most important source of daily news for most Americans. U.S. broadcast licensing policies were grounded on the assumed virtues of "localism," but for most American viewers television equated to network television. International television was sufficiently unique that most telecasts began, "Now, live via satellite." The "global village" of today still existed chiefly in futurists' imagination.

The three national networks and their owned and operated local stations annually accounted for half or more of total TV revenues and an even larger share of bottomline profits. Economic concentration in broadcasting was mirrored in related sectors. Five companies, for example, accounted for 20 percent, and 20 companies, more than 50 percent of total U.S. broadcast advertising expenditures yearly. A few firms, moreover, produced a lion's share of prime time entertainment programming.

Control of broadcast program content was gaining political acceptance. The litigation that was to yield the Supreme Court's 1969 Red Lion ruling and institutionalize the so-called "fairness doctrine" was underway. Pressures which resulted in 1970 Federal legislation barring broadcast cigarette advertisements were building. Its earlier coverage of the civil rights struggle and continuing coverage of the Vietnam War having demonstrated substantial power to mold public opinion and affect the national political agenda, the television industry's activities commanded significant congressional interest and, in some instances, concern.

AM radio still enjoyed commercial ascendancy, though its audience appeal was beginning to wane. FM radio listenership and profits were growing. Noncommercial or public radio and television constituted a small component of the nation's electronic news, entertainment, and information repertoire. Residential video cassette players were non-existent. Cable television systems served about 6 percent of U.S. households, chiefly in less well-populated and rural areas, where over-the-air reception was poor. There were no backyard "dishes" or receivers. Less than half America's households had color television. Most consumer electronics sold in the United States were produced in this country.

Computer and Information Services

The U.S. computer inventory 20 years ago consisted chiefly of large mainframe installations. Only a fraction were directly interconnected via communications. Computer demand was concentrated. The U.S. Government constituted nearly half of that market. Commercial banks, in aggregate, represented the single largest private sector application, other financial services had not yet significantly automated, as Wall Street "back room" clearance difficulties in the early 1970s were to attest. Only a few major firms relied appreciably on computers, and then chiefly for routine clerical functions -- billing, payroll, inventory, and the like. Management information systems, computer-aided design and manufacturing, and comparable cybernetics applications which are increasingly commonplace among all-sized U.S. companies today were neither generally available nor especially desired.

Two major non-Bell System, "independent" telephone companies -- GTE Corp. and United Telephone -- were significant domestic data processing service vendors. While AT&T was the largest single purchaser of computer products outside Government, a 1956 antitrust consent decree limited the firm to retailing communications services subject to regulation. Although communications links' cost and flexibility were increasingly relevant to computer operations, AT&T was considered neither a significant actual nor potential computer industry factor.

Nor was IBM Corp., with an estimated 70 percent of the world computer business, significantly involved in the U.S. domestic communications business. IBM's commercial position was strong, perhaps entrenched, as the Justice Department would contend in filing a major antitrust challenge. Two of its principal competitors (RCA Corp. and General Electric) would soon exit the computer equipment market.

Change With Some Continuity

Today, conventional voice telephone remains the telephone industry's principal commercial offering. AT&T is still the largest U.S. company in telecommunications. But the Bell System has been dissolved and for 85 percent of the country's 94 million telephone customers, effective, facilities-based, long-distance competition exists. Telephone customers also have an unimpeded right to use equipment of their own choosing, provided it is privately beneficial without being publicly detrimental. Equipment and service options only the very largest customers previously enjoyed have been "democratized," and in many cases are ubiquitously available. Business customers in some central business districts have a local fiber optic or microwave network alternative to the local exchange telephone company, at least for private line needs.

What constitute extraordinarily sophisticated new technologies -- including communications satellites, cellular mobile radio, and fiber optic (lightwave) transmission -- today are routinely taken for granted. Technologically and commercially, the telephone and computer industries are also increasingly intermixed and interdependent. These related industries' U.S. leaders -- AT&T and IBM -- face domestic and foreign competition in their respective core markets, while also being more directly competitive themselves.

Private communications systems are proliferating. Twenty years ago, regulated common carriers accounted for more than 90 percent of total U.S. equipment and transmission system sales. Today, regulated carriers account for slightly less than two-thirds, and non-regulated system demand is increasing more rapidly. Imports are also a major U.S. domestic communications market factor, and American telecommunications companies face intense competition both at home and abroad.

The ready availability of computer and communications capabilities has facilitated the expansion of many firms into regional, national, and global markets. A measure of the commercial significance accorded these capabilities is the growth seen in their relative share of the U.S. Gross National Product (GNP). Twenty years ago, communications and computer-data processing, narrowly defined, accounted for slightly less than 2.7 percent of an $892.7 billion, 1968 U.S. GNP. Today, they exceed 6 percent of a forecast 1988 $4.9 trillion GNP.

At present, industry investment in "information processing technology," measured by percentage of total investment in all equipment, ranges from 75 percent in the case of financial services companies, to 57 percent for machinery producers, to 24 percent in the apparel industry. For all U.S. manufacturing, the ratio of information technology spending to total equipment investment nearly doubled to about 20 percent between just 1980 and 1986. Since 1975, U.S. service industries have also increased their annual capital outlays on these "electronic tools" to nearly 25 percent from 3 percent of total equipment spending. Such heavy corporate investment in these particular technologies presumably reflects the value such applications yield. The trend is toward even greater future investment in information technology. That implies at least sustained and, more likely, significantly faster growth in GNP share contributed by communications and computer-data processing.

Increasing dependence by U.S. business and industry, as well as Government, on communications and computers has lent prominence to longstanding concerns including personal privacy, system integrity, and information security. Questions regarding the adequacy of existing safeguards, as well as technology's ability to evolve solutions to actual and perceived problems, are also increasing.

The broadcast business has also changed. Commercial network television remains the chief source of news, information, and entertainment programs. A small number of major buyers still account for most advertising expenditures. Concentration levels in the advertising agency business are continuing to rise. The number of companies producing prime time entertainment programming, larger than in 1969, still remains small. But network television's audience share has declined, from more than 90 to less than 70 percent of the total audience today (and only about 50 percent of the cable audience). The number of non network affiliated or "independent" television stations has also tripled. Public television's audience share has quadrupled to a firm 5 percent, and the institution commands strong public and political support.

Regulatory enthusiasm for broadcast content controls is on the wane, though there remains some concern about lifting substantially all restrictions on the part of Congress and some interest groups. Reflecting the realities of today's more diverse and pluralistic media marketplace, the FCC in 1988 rescinded the so-called "fairness doctrine." While not yet achieved, electronic and print media are closer to First Amendment parity.

Economically, radio and television broadcast revenues have not experienced growth rates comparable to the common carrier communications and computer-data processing fields. Broadcast revenues accounted for about 0.2 percent of GNP in 1968, and should constitute the same in 1988. Total capital investment in broadcasting, however, today stands at all-time record levels. There have also been substantial changes in the abundance of broadcast service routinely provided to most of the American public. Today, about 71 percent of U.S. households with a television can receive at least nine signals over the air, compared to only about 9 percent of households in 1968. Forty-nine percent of U.S. viewing households can receive 11 or more broadcast signals. The typical cable television subscriber has ready access to more than two dozen signals and in some cases more than one hundred signals. This constitutes an abundance of broadcast and video service options unparalleled worldwide.

Technological advances, including the advent of "mini-cameras," videotape, satellite relays, and electronic news gathering systems, have facilitated expansion in the amount of local television station news and public affairs coverage. Local news programs today constitute the second largest source of station profits after network compensation.

Computer technology has also significantly affected broadcast competition. Computerization makes simulating ad hoc networks to distribute programs and advertisements economically feasible. Advertisers thus have new options and alternatives to relying on established national television networks. Computer technology, in effect, has increased actual and potential competition both among local television stations, and between local stations and the national networks for critical national advertising dollars.

Satellite and other modern communications, together with the production equipment advances mentioned before, have revolutionized both radio and television news and sports event coverage. These same new technologies have helped to create national newspapers, and produced the long-heralded global village. Some 600 million people worldwide, for example, reportedly watched the 1982 marriage of the Prince of Wales. Some 2 billion viewed the 1984 Los Angeles Summer Olympics, and some 3 billion people have been forecast to watch this year's Games in Seoul.

In other sectors, FM radio has supplanted AM as the dominant audio medium. Ratings, for instance, show three FM for every one AM listener. Cable television systems now also pass more than 80 percent of the 91 million American households, and more than 60 percent of those passed subscribe. Video cassette recorders, moreover, are found in 58 percent of U.S. households. Some 2 million families, many in remote rural areas, command a veritable electronic "window on the world" through their own home satellite antennas.

Radio communications services and associated equipment markets are also more substantial than was true before. General population growth; consequent increased demand for state, Federal, and local government services; the rise of the service economy with its greater reliance on both private and common carrier mobile radio -- all have sharply boosted demand for radio services, and engendered new pressures toward improving government's management of the radio frequency spectrum. Law enforcement initiatives, programs undertaken as part of the national war on drugs, defense spending, and heavier reliance on improved command, control, and communications capabilities, similarly have triggered exponential increases in Federal demand for radio spectrum and equipment to meet overriding national security and other needs.

From "Scarcity" Toward Abundance

The U.S. communications business 20 years ago was characterized by relative and, in some instances, deliberate or administered scarcity of customer choices. For most users, telephone service and equipment alternatives were limited by company restrictions sanctioned by regulation. Prices often bore little direct relation to underlying costs. The range of viewing and listening options was also predetermined by the Government. A television channel allocation system established in the early 1950s artificially limited the number of stations technically feasible in most markets. That, in turn, tended to limit the number of possible national network television services. This government-created "scarcity," furthermore, became a justification for governmental regulation of broadcast program content, even at the expense of important First Amendment values.

Prior to the mid-1970s, government policy generally sought to sustain the status quo and, through internal subsidies and "public interest" exactions, to convert scarcity rents engendered by regulation into tangible public services. The government permitted a telephone company monopoly over equipment and long-distance services with the tacit understanding monopoly profits in some lines would go toward keeping local residential and rural telephone service prices artificially low. Television licensees were partly shielded from competition so they could fund "sustaining" news and public affairs coverage with the profits that limited Government protection ensured.

Internalized service subsidies were grounded on classical "market failure" or equity considerations. Broadly defined, competition is a means of ensuring that producers share their potential surplus with consumers. Where competition has been deemed infeasible, regulators -- both here and abroad -- often have sought to ensure redistribution of any producer's surpluses to consumers. Although couched in industry-specific rationales and associated jargon, most communications practices and policies were functionally equivalent to those applied in other regulated industries.

A Decade of Regulatory Reform

Not only in communications but in other regulated sectors, government policies began to change in the late 1960s and 1970s. Communications competition was first sanctioned in the domestic telephone business. Restrictions on customer terminal equipment choices were relaxed by the FCC in 1968 and, for all intents and purposes, removed in 1977. Limited "private line" competition was authorized by the FCC in 1968 and again in 1971. At the same time, the FCC adopted the "Open Skies" policy the Rostow Task Force recommended, which called for competitive development of the domestic communications satellite business. In 1977, limits on domestic interstate long-distance service competition were struck down by the Federal courts.

In broadcasting, FCC limits on pay cable television services were overturned by Federal courts in 1977. Shortly thereafter, the FCC removed other cable television regulations. The FCC established a new "low-power" television service and changed FM licensing rules to permit additional radio stations.

Following a decade of regulatory proceedings, U.S. cellular mobile radio service was finally permitted by the FCC in 1980. Additional channels were made available to paging services shortly thereafter. Specialized mobile radio systems, first authorized in 1976, proliferated. As importantly, the FCC took steps to limit the possible expansion of economic regulation through a series of rulings exempting computer data-processing services from Federal and state controls.

Traditional regulatory lines of demarcation also increasingly blurred. Broadcast channel subcarrier frequencies were employed for common carrier purposes. Cable television bridged traditional broadcast and telephone regulation. Common carrier satellite operations, in effect, broadcast video programs nationally.

The Bell System Breakup

The single greatest telecommunications industry change since the Rostow Task Force report was the Bell System breakup. Announced in January 1982 and effected in December 1984, the breakup caused a fundamental restructuring of the U.S. domestic telephone business. The parent company, AT&T, retained its manufacturing, research, and long-distance services operations. AT&T, however, divested local telephone, cellular mobile radio, and certain other operations.

Under the AT&T consent decree, ownership and control of about 80 percent of the Bell System's assets was assumed by seven regional Bell holding companies. AT&T subsequently also divested its substantial holdings in Cincinnati Bell and Southern New England Telephone Co. Indicative of the magnitude of the divestiture is the fact AT&T and all but one of the seven divested regional telephone holding companies today individually rank among the 100 largest corporations in the world.

Consent decree restrictions were placed on the divested Bell companies' permissible activities. They were prohibited from providing "information services" (including a subcategory of those offerings generally described as "electronic publishing"). Additionally, Bell companies were barred from manufacturing telecommunications equipment or engaging in long-distance communications between and among some 164 court-delineated, "local access and transport areas" (LATAs).

A stated purpose of the Bell System restructuring was segregating "natural monopoly bottleneck" and actually or potentially, "effectively competitive" activities. The Bell companies were substantially restricted to providing regulated monopoly services. AT&T's diversification into new fields, such as unregulated computer data-processing, was permitted. A 1956 antitrust consent decree limiting the Bell System to offering communications services subject to public regulation was, in effect, lifted from one-fourth the System's capital assets and human resources (i.e., from AT&T).

Additionally, many divestiture proponents expressed hope it would facilitate eventual deregulation of AT&T's long-distance services.

The decree placed new obligations on the divested Bell companies. Principally, Bell companies were required by September 1986 to provide all "interLATA carriers" under tariff with "equal access" to local exchange facilities. Additionally, Bell companies were required to procure equipment and services on an openly competitive, nondiscriminatory basis. A central services organization, subsequently named Bell Communications Research Corp., was established to coordinate Bell company national defense and emergency preparedness activities, and to undertake research, development, testing, and engineering in support of Bell company provision of permissible communications services. The breakup also introduced a new regulatory factor, namely the consent decree court.

Regulatory Pricing and Cost-Allocation Reforms

Contemporaneous with the judicial restructuring of the Bell System, the FCC undertook a major realignment of traditional pricing and cost-allocation practices and procedures. A purpose was to align service prices more closely with underlying costs. The FCC shifted some of the cost burden associated with maintaining artificially low residential customer prices. Previously buried in long-distance telephone rates, some cost burdens were now levied directly on subscribers through "end-user access charges."

In addition, the FCC took steps to heighten the visibility of other industry-devised and administered subsidies, particularly those flowing to rural telephone companies. The agency established an industry organization, the National Exchange Carriers Association, to administer the cost and revenue apportionment between local and long-distance operations previously undertaken by AT&T. Subsequently, the FCC adopted regulations aimed at maintaining "universal" basic telephone service. These regulations provided for some of the cost of "lifeline" services and telephone installations to be supported by long-distance service users generally.

Accommodating Differing Policies

Divestiture and steps toward deregulation were grounded on assumptions many communications markets had or could become actually or potentially competitive. A goal was to foster that competition and, by so doing, expand customer choice while more closely aligning prices with costs. A parallel goal was reducing the level and intensity of Government economic regulation of the telephone business to encourage innovation, stimulate efficiency, and lessen interference with private decisionmaking generally. Not all goals were pursued with equal vigor, however, and in several regards, compromise between the economically desirable and the politically achievable was required.

Changes in telephone industry structure and associated regulatory practices placed at some risk a number of those interests which had benefited significantly from the status quo. These included interests of both industry groups as well as some residential and rural telephone customers. Complicating the FCC's task of striking an equitable balance among often conflicting competitive, economic, and social goals was the assumption of broad regulatory powers by the court administering the AT&T consent decree, together with increasing ad hoc intervention in decisionmaking on the part of Congress.

Broadcast Deregulation

In broadcasting, changes in regulation were driven by an assumption that licensees competing for listeners and viewers are better able to assess and meet audience needs than Federal regulators. A regulatory priority in recent years has also been lessening unwarranted government impingement on First Amendment freedoms and ensuring greater free speech parity between press and electronic media. The FCC also sought to increase the number of radio and television stations that could be licensed to the maximum extent possible.

Rules governing broadcast investments were removed or redesigned, causing significant ownership changes. Both within broadcasting and among public interest groups, less regulation, technological changes, and more competition unsettled expectations in a field previously known for stability and predictability. Differentials in public interest impositions among competing media also raised concerns. Broadcasters remained subject to public interest obligations, for example, while cable competitors were not. While the uniqueness of broadcasting diminished, resistance to reflecting that reality through regulatory reforms remained strong in some quarters.

Persistence of Internalized Subsidies

Residential telephone service in the United States traditionally has been priced substantially below cost, as in virtually all other developed countries. Industry cost allocation and pricing practices recovered the difference between the price charged for local residential telephone service and the cost to provide that service by charging business and long-distance users more than the cost of providing them service. Throughout the 1950s and 1960s, interstate long-distance services were an increasing contributor of local subsidy dollars through a practice referred to colloquially as "toll loading." On average, notwithstanding the instituting of end-user access charges, local residential service prices continue today to cover significantly less than the cost of providing service.

The cost of providing "universal" telephone service at "affordable" prices in rural areas was also defrayed, in part, through direct Federal subsidies administered by the U.S. Department of Agriculture's Rural Telephone Administration. In addition to some $6 billion in low-cost Government loans, rural telephone companies received substantial operating subsidies through the traditional "separations and settlements" process administered by AT&T. Interstate long-distance prices have been averaged by AT&T; interstate toll calls thus are priced solely on mileage, without regard to a call's origin or destination.

Despite changes in industry structure and some alterations in cost allocation and pricing policies, the fundamental policy of providing residential and rural telephone service at below-cost prices has remained in place largely unaltered. At present, inter- and intrastate long-distance customers pay prices which are billions more than the cost of providing toll services. Long-distance carriers collect this amount and, in effect, remit it to local exchange companies through the prices paid for local exchange connections. Part of the money is then used by local companies to maintain residential and rural prices at below-cost levels.

This substantial internalized subsidy has consequences which are not necessarily consistent with a general policy goal of maximum possible competition and prices reflective of individual carrier efficiencies and actual costs. Large payments for local connections mean the cost structures for long-distance carriers are similar, with local exchange charges typically amounting to about 50 percent of a toll carriers' total costs. The amount of actual and potential price competition in toll markets is thus reduced. Because local telephone customers do not pay the full cost of local service, they also presumably have some propensity to over-consume local service offerings. This is particularly true as relatively few U.S. telephone customers currently pay for local service on a usage-sensitive basis.

Significant strides have been made toward increasing the visibility of intra-industry and inter-user subsidies. Nevertheless, the traditional U.S. practice in this sector of funding socially or politically desirable objectives indirectly through internalized transfers persists, and with little apparent short-run prospect of reversal.

A similar predilection for internalized subsidies is reflected in prevailing broadcast policies. Licensees are still, in effect, obliged to air certain general classes of programming as part of their "public interest" responsibilities. Similar, though less onerous, obligations on cable television were authorized by comprehensive 1984 Federal legislation. These circumstances, while they may prove a means by which broadcasters can differentiate their product in an increasingly competitive business, also have the potential to skew development of our overall video marketplace.

Continued Economic Regulation of AT&T

Nor has restructuring and increased competition in the telephone business necessarily diminished Federal economic regulation of the principal firms. AT&T's share of interstate long-distance telephone revenues has decreased annually in the almost five years since the Bell System breakup. One estimate is that AT&T's current share is about 75 percent of the market. Rapid expansion of AT&T's long-distance market competitors' plant has also reduced the firm's share of total engineered plant. One estimate is that AT&T's long-distance facilities account for slightly less than half the U.S. domestic intercity total.

Although a number of state regulatory agencies have removed all or substantially all economic regulation from AT&T's intrastate services, its interstate offerings remain nearly as regulated today as in the past although rates have dropped significantly. The FCC has permitted AT&T greater pricing flexibility, but on a case-by-case basis. The agency has also commenced a program looking toward instituting "price caps" in lieu of traditional price and profit controls. Under this proposal, interstate prices are allowed to rise or fall only within prescribed ranges, and profits are not rigorously regulated. Such an approach would likely stimulate the firm toward significantly greater efficiency. Just as defense procurement has moved away from "cost plus" contracts that tend to breed less efficient behavior, telephone regulators have begun to move away from "cost plus" rate of return regulation. Virtually all AT&T's direct interstate and intrastate long distance competitors, however, today are free of significant economic regulation, while AT&T remains nearly as regulated at the Federal level as before.

New Limitations on Customer Choice

Competition has generally increased the conventional service and equipment choices available to most U.S. telephone customers. Competition within the computer-data processing field, and the FCC's determination not to impose economic regulation on that sector, have also contributed to the range of information service options available to some customer groups. Certain government limitations placed on the telephone industry in the name of safeguarding competition, however, have limited the new service choices which might otherwise be available to many ordinary residential and some small business telephone customers. These include information services now available to large businesses or residential customers with personal computers, modems, and telecommunications software; such services include financial transactions, sports and weather information, educational programs, and access to thousands of data bases worldwide. An overwhelming focus of FCC and judicial regulation to date has been on minimizing the possibility of unfair competition or cross subsidies by telephone companies. Less emphasis has been placed on assuring a more equitable and ubiquitous availability of new information services or in obtaining the benefits of synergy from telephone system assets.

Broadcasting Controls

The continuation of intensive government regulation, despite erosion of those market conditions which might once have warranted more intervention, is not a phenomenon limited to domestic common carrier regulation. The FCC placed a series of restrictions on the national television networks in the early to mid-1970s. Although any network hegemony has to a large degree attenuated, most of those restrictions remain in place.

The FCC restricted the ability of the national television networks to provide programming to be aired by their own local stations or affiliates during a "prime time access hour" (generally 7 to 8 p.m. EST). The FCC further restricted the ability of affiliates to broadcast programs previously run by the national networks during that time period. The purpose of this Prime Time Access Rule was to expand sales opportunities for television programmers and thus, in theory, foster a more competitive, economically stronger, and more diverse programming business.

Relatedly, the FCC placed restrictions on the amount of prime time entertainment programming the national television networks can produce for themselves. Limits were placed on the ability of networks to share in the revenues from post-network run showings of television programs or to participate in the U.S. domestic program syndication market. The national television networks also were restricted from participating fully in the ownership of cable television systems or cable television networks. Consequently, the national television networks have been more restricted than cable television firms with which they increasingly compete both for audiences and advertising revenues. Cable firms were largely deregulated in 1984, moreover, and yet retain mostly exclusive local franchises.

Notwithstanding more pluralistic and competitive mass media markets, special restrictions have also persisted for radio and television broadcasting generally. FCC rules limit the total number of broadcast outlets any single firm can own. There are no limits, however, applicable to cable television systems, although there has been recent Congressional interest in imposing such limits. FCC rules also prevent the acquisition of collocated newspaper and broadcast outlets, or transferring radio-television combinations, without regard to how many broadcast voices operate in a particular market (or whether antitrust standards applicable to mergers and acquisitions generally are exceeded). These limitations are based in part on concerns for maintaining diversity in a community and while some level of concern remains appropriate, existing rules and limitations are substantially broader than necessary.

Special statutory restrictions on broadcast and other electronic media also persist. Broadcast stations are required to sell advertising time to candidates for Federal elective office, and to do so at their lowest unit rate, thus extending to candidates the benefit of volume discounts often offered to major advertisers. Broadcast and cable systems are also subject to "equal time" obligations, which require all candidates for a given state or Federal office be accorded equal coverage, if any candidate is given air time. Until it was largely abrogated by the FCC in 1988, broadcasters were also subject to the so-called "fairness doctrine," by which government mandated both the coverage of controversial issues of public importance and affording all sides to a given issue comparable, if not absolutely equal, coverage.

These special FCC regulations and associated statutory requirements reflect traditional assumptions regarding electronic media scarcity in a time of media abundance. They reflect reluctance to forego the application of potentially coercive government power notwithstanding the disappearance of the principal stated rationale for such intervention in the past, namely, promoting needed diversity in the presence of excessive private economic power. An issue today is how long it will take to correlate regulatory practice with marketplace realities, or to base the use of government power on a new rationale.

Increased Faction and Divisiveness

A benefit of the competition and new entry characteristic of most U.S. domestic and international communications markets has been a heightened opportunity for more people to participate, and hence desirable dispersion of commercial decisionmaking. Just as competition has tended to broaden customer choice, it has also generally afforded more and more individuals a greater chance to compete to satisfy that expanded choice.

This has been a positive development. New capital and human resources have flowed into most communications markets. Competition has uniformly stimulated demand and made the total business grow, resulting in a richer and larger marketplace. Because no single company or small group of firms, no matter how talented, can reasonably be expected to satisfy all demands in fast-growing, technologically and commercially dynamic markets, the procompetitive and open entry policies pursued over the past two decades have yielded substantial national and public dividends.

In the common carrier field, the FCC generally has followed open entry policies. Its policies reflect the assumption, validated by experience, that permitting all -- including established firms -- fully and fairly to compete is the optimal approach. Those policies are premised on a reasoned confidence in effective marketplace competition reinforced by regulatory safeguards and secured by the antitrust laws. The FCC has thus sought to change past policies which were grounded on the notion that competition could be ensured only through tight controls and absolute prohibitions of potentially beneficial commercial activity by certain firms. It has recognized that such broad and indiscriminate exclusionary policies can impose unacceptable direct and opportunity costs.

At the same time, the past few years have also marked the emergence of potentially debilitating, high-risk trends. Notwithstanding FCC policies favoring open entry with regulatory safeguards, flat prohibitions on competition in certain markets by some categories of companies have been imposed by Congress, the courts, and state regulators. The AT&T antitrust consent decree flatly bars Bell company competition in certain telephone-related markets. Cable television legislation enacted in 1984 attempts to limit video competition between local telephone and cable companies. State regulators continue to restrict competition with local telephone companies. Legislation was passed in 1985 to forestall regulatory change which might have increased competition between national television networks and program producers and distributors. On varying recent occasions interest groups including security and alarm services companies, mobile radio service vendors, information service firms, telephone companies, and newspaper publishers have sought some form of government action restraining or foreclosing actual or potential competition.

This propensity on the part of commercial interests to seek special government protection is, of course, not new. It has even been described as a commercial rite of passage, evidence marking the point when an insurgent becomes an incumbent in a given market. The level, intensity, and sophistication of efforts to obtain such protection, however, is increasing, commensurate with the degree of actual or perceived competition in communications markets. In notable regards, a result has been policy "gridlock" caused by special interests which capitalize on the limited time and attention Congress is able to accord any given set of issues. Too often, regulators and legislators have confused private commercial interests with the overall public interest.

Our democratic free-enterprise system has reliably functioned in the best interests of citizens and rests on strong public support. That public support depends, in turn, on our system continuing to be perceived as functioning in the best interests of all people, not just a few. If the public believes the system is not working both fairly and well, the consensus in favor of competitive market solutions could be imperiled. It is important, therefore, that the system be seen by the public as well as market participants as being responsive to the needs of society in general.

Introducing competition into previously monopolized, pervasively regulated sectors almost always engenders transitional problems. It serves everyone's interests if government ensures that the cost and burden of changes aimed at benefiting society as a whole are not unfairly visited on any one group. There is thus a legitimate government role to be played in maintaining that necessary political consensus in favor of marketplace solutions.

A sound balance, however, must be struck. Excessive faction and corporate self-seeking, and a proliferation of forums in which pleas for special treatment can be advanced, can be destructive of, not promote, effective competition. If firms perceive an easy opportunity to secure through Government regulatory or other actions the financial benefits otherwise obtainable only through timeconsuming and costly commercial endeavor, they are more likely to compete more before government than in the marketplace. Market solutions, in effect, could be crowded out by nonmarket alternatives and government intervention.

This, in turn, has potential to lessen predictability, with consequent adverse effects on capital markets, and, indeed, to deter potentially beneficial commercial undertakings altogether. For where firms might be prepared to take risks on the assumption their market talents will suffice, they almost certainly will be less willing to do so when the perceived key to success is adroitness at manipulating the Government and its processes.

Steps should also be taken which lessen the chance for duplicative or conflicting government actions. This does not mean Federal preemption of state regulation is desirable. Generally, it is not. As a practical matter, the FCC and state commissions have attempted to work collaboratively in recent years, and this may continue to suffice. The present situation, however, where procompetitive, deregulatory initiatives can be blocked by the different views of a single Federal district court is unsound as a matter of fundamental policy. It is axiomatic that communications policies should be made and implemented by those expert agencies charged by Congress and state legislatures with doing so.

The ability of government to proceed in complex commercial environments is integrally related to the presence of a "safety valve." Measures should be preserved that will continue to afford all interests including the general public a full and fair hearing. Too often in the recent past, however, a multiplicity of such supposed safety valves, each under differing control, has prevailed. "Undue process," delay, and gridlock have been the result. If we are to ensure the full benefits of competition in communications markets, steps are desirable that will reduce current faction, delay, and excessive process.

Converging Forces For Change

Commonplace is the contention that technology alone contributed to the substantial changes experienced in communications markets over the past 20 years. Certainly technologies have created a gravitational pull on regulatory structures based on technological foundations which have crumbled. But technology alone has not been responsible for change.

Government policy can dramatically affect the pace with which technology is developed and deployed commercially. A wide variety of economic, business, demographic, and other factors typically bear heavily, if not decisively, on any industry's development and performance. In this part, therefore, technology as well as other forces which converged to cause changes in communications markets over the past few decades are briefly reviewed and discussed.

Fundamental Technologies

Fundamental to the changes occurring in almost all communications markets was the advent of microelectronics, a technology pioneered in the 1950s by AT&T Bell Labs. Microelectronics -- the popular "silicon chip" -- functioned as both a major demand-inducing and cost-reducing building block for change, and one which has proven amenable to ubiquitous application.

The initial practical application of this technology occurred largely under government auspices, particularly as part of the NASA space effort. Microelectronics rapidly spilled over to ever-widening commercial use, however, which, in turn, caused major communications industry changes.

Widespread application of microelectronics by the computer-data processing industry caused rapid growth in the number of computer installations. That, in turn, created new user demands for digital communications and terminal equipment different from that which established telephone companies were then willing to supply. Unlike some previous technologies, furthermore, knowledge regarding the potential of microelectronics was widely dispersed. Many, in addition to the traditional telephone industry suppliers, and some with an aggressive, entrepreneurial approach new to telecommunications generally, began commercial exploitation of microelectronics by the seventies.

In the 1970s, computer processing costs plummeted. That contributed to a proliferation of units and an expansion in their computational capabilities, with attendant "demand-pull" effects on the telephone and other industries. Additionally, the application of this technology in communications sectors led to new products and services.

Microelectronics made mini-cameras and an array of other products feasible in broadcasting which, in turn, revolutionized the economies of both program production and distribution. The technology made increasingly efficient satellite communications systems possible. It resulted in computerized telephone switches;

those, in turn, made computer-controlled mobile radio offerings -- today's popular "cellular radio" -- technologically possible. Including a "processing" capability in other radio transmitting and receiving equipment made it possible to send more messages and information using the same or less radio spectrum. Importantly, the synergistic interplay of computers and communications, in turn, accelerated the pace of change.

Through computers and communications, researchers gained faster access to more and more information. They also acquired ready means more effectively to build on previous research results. The example of commercially feasible fiber optic communications is a prime case in point.

That lightguides could, in theory, provide very broad-band, high capacity communications links was well known among researchers in the 1950s. It was not until about 1970, however, that researchers had the electronic tools available to explore methods of practically applying lightguide theory. Fiber optics, in essence, entails advanced chemistry applications and chemistry relies heavily on mathematics. Efficient and effective computers, facilitated by microelectronics, made possible the mathematical computations which, in turn, made possible the advances in chemistry which, again in turn, produced workable fiber optics.

Microelectronics thus led to this marvelous new technology and its commercial application. Microelectronics, incorporated into computers and aiding in sophisticated communications, also produced widespread dispersion of the original research demonstrating the means of making fiber optics and the necessary advanced lasers. One researcher's findings, moreover, could rapidly be built upon by others. Consequently, the United States was able to experience the progress of a pivotal new technology from the fundamental research laboratory to nationwide fiber optic networks in a relatively short time.

Commercial Dynamics

Contributing heavily to the rapid development of microelectronics and the communications applications relying on that new technology were fundamental shifts in the nature of commercial demands.

When the Rostow Task Force was deliberating, the United States was as a former Treasury Secretary put it, "an economic Gulliver standing astride a world filled with Lilliputians." U.S. manufacturing output in the late 1960s nearly equalled that of the rest of the Free World combined. Buttressed by cheap energy, favorable tax policies, relative freedom from environmental and other social policy impositions, and buoyed by fast growing domestic markets, U.S. business and industry experienced unparalleled profitability. Imports and exports represented less than 10 percent of the U.S. GNP combined.

Conditions and commercial circumstances began changing at an accelerating pace, however, shortly after issuance of the Task Force's report. Inflationary pressures produced international financial change. Contemporaneously, the sometimes painful process of integrating the United States commercially into the world economy began. Parts of our economy slowed, while interest and inflation rates soared. Greater and better import competition, a desire to maintain profit margins in the face of dwindling domestic markets, and inflationary pressures all have more recently prompted actions by major U.S.-based firms.

First, new cost-reducing measures were explored and adopted, and communications and computer-data processing figured heavily in this. Second, a number of businesses adopted "forward defense" policies by seeking to expand their domestic operations to compete more aggressively abroad. This strategy was pursued especially by U.S.-based financial services companies, which moved rapidly into the less regulated world financial markets which the elimination of fixed exchange rates and resulting expansion in world trade activity helped cause.

Greater commercial use of and reliance upon communications and information resources was a prime driving force behind the fast growth in domestic and international telecommunications markets which the United States experienced. Communications companies strived especially to meet the new demands of their major customers. This phenomenon, moreover, extended beyond simply communications common carriage. In broadcasting, for example, local stations moved to exploit the new service capabilities of microelectronic-dependent technologies. Electronic news gathering systems made possible new local and other coverage that attracted audiences. Contemporaneously, the computerization of the advertising business, mentioned above, made it possible for local stations -- increasingly competitive factors in national ad markets -- both to fund new services initially and subsequently to capitalize commercially on the new audiences which those services delivered.

Cable television growth was fueled by this new technology and the profit opportunities it afforded. Satellite communications made nationwide pay cable television networks commercially feasible. The earnings that resulted, in turn, made rapid expansion of cable television systems and rising household penetration possible. That increased penetration made feasible the increasing number of new program services which have so substantially contributed to national diversity. Radio also capitalized on satellite communications. That technology made it feasible for stations to reduce some costs while adding new services.

As communications markets in general became more competitive, and firms sought to match the communications and information resource capabilities that their competitors enjoyed, the rate of change accelerated. Once a critical mass of firms in an industry adapted to these new technologies, others moved rapidly to incorporate them into their way of doing business as well.

American Demographic Changes

At precisely the same time new, microelectronics-based communications and information systems were materializing, and the business community was moving to exploit more effectively those systems' capabilities, fundamental changes were taking place in the U.S. population which tended to drive the process of change forward.

First, and most notably, the population of the United States grew substantially. In 1988, there were some 44 million more Americans than in 1970: growth representing the equivalent of two-thirds the total current population of West Germany. Increased population, particularly in densely inhabited urban areas where some three-quarters of Americans now live, increased demand for a variety of services that were communications-dependent.

Between just 1980 and 1984, for example, total law enforcement expenditures by all governments grew some 80 percent (to about $40 billion from $22 billion). During that same period, Federal law enforcement expenditures increased 128 percent. There was an 86 percent increase in state and a 69 percent increase in local law enforcement budgets. Reliance upon radio and other communications resources by law enforcement and other public health and safety agencies experienced commensurate increases, which both stimulated demand for equipment and increased overall radio frequency management challenges.

Second, population growth as well as changes in certain key sectors also increased demand for government services. Especially since the removal of economic regulation of the commercial air cargo and passenger businesses in the late 1970s, for example, there has also been a surge in air transportation, and a corresponding increase in demand for the communications and information systems needed to manage this traffic. In 1970, only about 10 percent of the population had flown commercially during the preceding three years. Last year, nearly one-third of the American public reportedly took a commercial flight. There were some 450 million domestic boardings in 1987, and some 12,000 takeoffs and landings every day. Again, much greater demand for communications and information processing was a clear result.

The period after 1970 also saw substantial increases in U.S. individual income and expenditure levels. Between 1970 and 1985, per capita income rose about 30 percent and per capita expenditures rose about 34 percent, measured in constant 1982 dollars. Increased propensity to consume fueled increased spending on advertising, which caused, in part, substantial changes in the broadcasting business.

In addition, there were predictable changes in the magnitude and character of demand for other communications services. Most basic communications requirements -- universal basic telephone service, for example -- had been met in the early 1970s, if not somewhat before. The market's priorities, therefore, shifted from meeting basic customer needs to satisfying new customer desires. Additionally, as an increasing number of women worked outside the home, demand for time-saving measures grew. The rapid growth of retail electronic banking and telephone order sales was a result. More spending in general, plus spending on communications and related products in particular, had a significant effect on the development of telecommunications markets.

Contributing to the rapid development of telecommunications markets, as well as the advances in technology seen during the post-1970 period, was the national investment in education begun in the late 1950s and 1960s. Total U.S. expenditures on education and training rose from some $24.7 billion (5.1 percent of GNP) in 1960, to $163 billion (8.6 percent of GNP) in 1978. Despite declines in the school age population, expenditures increased to $244 billion (6.1 percent of GNP) in 1985. The number of institutions of higher learning expanded from 2,566 spending $23.4 billion in 1970 to 3,331 spending $82 billion in 1984. The national median years of school completed rose from only 10.6 years in 1960 to 12.6 years in 1980.

Government Policies

Government policies also contributed to and accelerated the rapid changes the United States experienced in telecommunications. In the 1960s, for example, regulatory agencies began to alter the procedures used to apportion telephone industry capital costs and expenses between the interstate and intrastate jurisdictions. New methods were adopted in 1970. For the former Bell System alone, the proportion of telephone subscriber plant costs assigned to interstate operations grew by approximately 50 percent between 1970 and 1982. The FCC found that, as a result, about $5 billion more in costs and expenses were assigned to interstate operations than would otherwise have been the case.

This substantial cost burden, which was placed on established long distance operations, together with regulatory decisions limiting the ability of AT&T to lower its prices to meet new competition, provided a powerful stimulus to entry. At the same time, regulatory policies directed that new entrants into the interstate long distance telephone market be accorded a 55 percent reduction in the amounts paid for local exchange access relative to AT&T. Again, the result was to encourage entry.

The rapid development of the U.S. domestic satellite communications business also benefited from government policies. Satellite technology was initially underwritten by NASA and the Defense Department. In the 1970s, the Government provided satellite launch services at levels which fell short of appropriately allocable costs. A result was to stimulate the rapid expansion of U.S. domestic satellite communications capacity. This, in turn, aided in the expansion of the cable television industry, as well as increased reliance by over-the-air broadcasters on satellite communications. The development of the cable television industry was further encouraged by enactment of special, preferential copyright legislation, according the industry a statutory compulsory license for which it paid an administratively set, not marketplace determined, royalty fee.

U.S. trade and trade-related policies also affected the development of domestic and international communications markets. During the 1970s, imports of color television receivers -- the products that typically account for about one-quarter of total consumer electronic sales annually -- surged. Imports from Japan averaged one million units a year between 1971 and 1974, but then doubled to two million units by 1976. An "orderly marketing agreement" was negotiated with Japan in July 1976, by which time television receiver imports from Taiwan and South Korea were increasing rapidly. An orderly marketing agreement was reached with these two latter countries in February 1979. Antitrust litigation commenced by Zenith and other U.S.-based television receiver manufacturers in 1971 was not resolved until 1987, 16 years later (with a conclusion that "dumping" by Japan-based firms had occurred). Not unexpectedly, the number of major U.S.-owned manufacturers of television receivers declined from about 18 in 1970, to 4 in 1982, and only 1 in 1988 (which is now under pressure from certain investors to sell its consumer electronics business).

U.S. experience in parts of the telephone equipment market is similar. The FCC in 1976 adopted regulations which greatly liberalized the terms and conditions of entry into the customer-premises terminal equipment market. Unlike virtually all other developed countries, the United States more than a dozen years ago adopted what today is known as a "no-harm-to-the-network" standard. An effect was to open the customer-premises equipment market, currently accounting for about $6 billion in annual sales, to competition, including competition from foreign-based equipment manufacturers.

The Bell System breakup, and the requirement that the divested Bell companies employ nondiscriminatory procurement, caused the most significant change and substantially increased U.S. domestic sales opportunities for foreign-based equipment manufacturers. Again, this was done unilaterally and significantly in advance of any reductions in nontariff trade barriers to U.S. telecommunications exports abroad.

A result of these regulatory and telecommunications industry structural changes was asymmetrical market access conditions. That market asymmetry, coupled with general economic factors including currency imbalances and more rapid growth in the United States than some other economies overseas, combined to yield substantial and still growing U.S. telecommunications trade deficits. Our trade balance in telecommunications equipment alone deteriorated from an $817 million surplus in 1981 to a $2.6 billion deficit in 1987.

Echos of U.S. Developments Overseas

Changes in U.S. communications and information services markets are reflected in some of the changes which have occurred and are occurring in other countries. These changes are due, in part, to the fact that many of the forces for change manifest here -- new technology, demographic changes, and greater emphasis on efficiencies believed to result from more reliance on these "electronic tools," for example -- are increasingly universal phenomena. They also reflect marketplace pressures to conform with changes occurring in the world's single largest communications market, the United States. The dynamic effects of U.S. domestic deregulation and competition, in short, are themselves having an international impact and driving many other countries in the world toward liberalization, i.e., more procompetitive policies.

Foreign Telecommunications Policies Generally

In nearly every country, telecommunications policy has commanded increasingly high political priority. Commencing in the early 1970s, the French

Government, for example, undertook a major program to increase the availability and technological sophistication of France's telecommunications infrastructure. In about a decade, France progressed rapidly to where that nation today enjoys a domestic communications system superior in many regards to any in Europe.

Less industrialized countries such as Bangladesh, India, and the People's Republic of China have also emphasized telecommunications development. Communications in these nations has generally been regarded as a promising means of ensuring the more efficient functioning of the economy at large. The emphasis has been chiefly on developing domestic capabilities, rather than fostering telecommunications exports. Extensive international loans, foreign aid and assistance, and concessionary financing have helped. In certain high-tech sectors, moreover, less industrialized countries have made major gains. Both India and China, for example, today are significant factors in space satellite markets. The Indian computer and information services sector is the most advanced among nonaligned countries.

Newly industrialized nations such as Brazil, South Korea, Hong Kong, Taiwan, and Singapore have stressed not only major modernization of their domestic telecommunications systems but expanding their exports of communications equipment as well. Because most European countries until recently have limited equipment imports, however, and most developing nations have strong indigenous manufacturing requirements, the telecommunications exports of the "Four Tigers" and Brazil have tended to flow one-way into the open U.S. market.

The European Community (EC) has increasingly concentrated on telecommunications development. Substantial government-funded research projects have been undertaken, particularly since announcement of the Bell System breakup in 1982. An EC "Green Paper" released in 1987 called for harmonizing European telecommunications standards and somewhat greater competition in certain market sectors, such as communications equipment, in preparation for the reduction of all EC trade barriers set for 1992. In addition, regional communications satellite systems such as EUTELSAT have been developed on a multinational, cooperative basis.

The Free World's third largest economic power, the Federal Republic of Germany, has also proposed a number of major telecommunications policy changes, and legislation implementing those changes is likely to be enacted soon. In general, West German telecommunications policy seems aimed at fostering competition in communications equipment and new, computer-related "value-added" and "enhanced" services, while limiting actual or potential competition in the basic telephone operations which comprise more than 80 percent of the total West German communications market today. Long regarded as having among the most restrictive telecommunications environment in the world, the changes now under consideration by the West German parliament represent major reforms.

International communications policy challenges are reviewed more extensively in subsequent chapters. Here, however, the experiences of three major developed countries in the immediate post-Rostow Task Force era are discussed, with an emphasis on changes made or considered in their domestic common carrier communications regulatory schemes.

The Japan Experience

On October 23, 1982, legislation was enacted revising Japan's 1953 Public Telecommunication Law for the purpose of allowing greater competition in Japanese domestic and international communications markets. The 1953 Law had established Nippon Telegraph & Telephone Corporation (NTT) and Kokusai Denshin Denwa Co., Ltd. (KDD) as legal domestic and international facilities and service monopolies. The 1982 revisions were based on extensive research and a review of communications policies worldwide which commenced in the late 1970s. Together with regulations issued by the Japan Ministry of Posts and Telecommunications (MPT) effective in April 1985, the new law reduced the scope of the NTT and KDD monopolies. With such liberalization, NTT's only lawful monopoly markets became basic local telephone services, telex, and telegram.

The new Japanese regulatory scheme was founded on distinguishing between facilities-based (Type 1) and non-facilities based or resale (Type 2) carriers. In essence, the system sought to encourage entry into new, computer-related communications services -- what are referred to as "enhanced services" in the United States -- on a resale basis. Entry into this developing market on a facilities basis was subject to more regulatory controls. Entry into conventional voice communications markets on either a facilities or resale basis was more difficult still. Strict technical standards and testing requirements which previously had limited competition in customer-premises equipment were relaxed.

Several considerations played a part in Japan's liberalization. U.S. trade-related pressures to expand the competitive opportunities available to U.S.-based firms, or Japan-based consortia in which U.S. firms could participate, were important. Also significant was a sense on the part of Japan's government and business community leadership that efficient development of its telecommunications infrastructure was lagging. At the time, Japan, with some 37 telephone mainlines per 100 population was lagging the Organization for Economic Cooperation and Development (OECD) member country average of 38, and was considerably behind the 48 mainlines per 100 population level achieved in the United States. Competition was viewed as a means of stimulating NTT to perform more effectively -- much as competition in the U.S. domestic telephone business had been initially sanctioned as a "competitive spur" to AT&T.

Japanese telecommunications policy is said closely to follow U.S. policy initiatives. Key differences, however, include a manifest desire on the part of regulators to minimize the chance that "excessive" transmission capacity may be deployed, by encouraging competitive entry on a resale rather than facilities basis, and the persistence of significant resistance to imports, particularly in the case of network products (e.g., central office switching and transmission systems).

There is no perfect measure of the effectiveness of Japan's efforts. Telephone revenue and traffic growth rates in most OECD nations, however, usually have outstripped overall Gross National Product (GNP) growth rates, reflecting increasing reliance on communications both in the United States and worldwide. Between 1986 and 1987, Japan's GNP rose by about 4.3 percent. Total Japanese domestic telecommunications market revenues are not available. Revenues for NTT, however, which overwhelmingly dominated the market during that period, increased about 5.1 percent. Assuming NTT's growth is a reasonable proxy for the market as a whole, this telecommunications growth rate is not as strong as in other national markets where the amount of existing and permissible competition is higher.

If Japan's domestic telecommunications market growth is more stimulated in the future by competition, an effect could be to reduce the current severe telecommunications trade deficit between Japan and the United States. Faster growth could also mean greater competitive opportunities for U.S.-based companies, particularly in the "value-added network" field where, in general, easier entry rules and the absence of economic regulation prevail, and American companies have demonstrated substantial commercial talent.

The United Kingdom Experience

British telecommunications policy reform commenced in 1981 with the segregation of the British Post Office's communications and postal operations. As in Japan, extensive analysis of both the British and overseas communications markets was conducted. Again, there was a consensus that liberalizing the rules governing communications markets would stimulate growth and improve service quality and, as one expert study commission observed, make sure that Britain's "leadership in this sunrise high-tech sector is not eclipsed."

The resulting Telecommunications Act of 1984 called both for the eventual privatization of British Telecom (BT), accomplished in part later that year, and liberalization of domestic communications regulation. Subsequently, the Government adopted a so-called "duopoly policy." This policy allows for across-the-board competition in common carrier services between BT and the domestic subsidiary of Cable & Wireless PLC, Mercury Communications.

The British pioneered advanced telecommunications economic regulation techniques, implementing a "price caps" system which currently applies to about 60 percent of BT's operations. That approach is now being seriously considered both in Japan and the United States, as previously mentioned. "Target efficient" economic regulation, coupled with the spur of competition and major efforts to upgrade British telecommunications after years of Government ownership, have apparently resulted in high revenue and traffic growth.

The absence of comprehensive British domestic communications market statistics requires relying on BT revenue figures as a reasonable surrogate. Those figures indicate annual revenue growth exceeded 9.5 percent for each of the first two years after privatization. Between 1986 and 1987, BT's revenues increased some 12.4 percent. During the period 1984-86, Britain's GNP increased by 3.3 percent. Between 1986 and 1987, it increased at a rate of 5.2 percent, the fastest of any OECD member country.

The Canada Experience

Although there are more than 250 Canadian telephone companies, Bell Canada, incorporated by act of Parliament in 1880, serves about 60 percent of the Canadian domestic market. It, and British Columbia Telephone, controlled by the U.S.-based GTE Corp., are subject to extensive and intensive economic regulation by the Canadian Radio-Television and Telecommunications Commission (CRTC). Provincial authorities regulate other companies. In the prairie provinces, phone companies are government-owned.

Domestic long distance communications is essentially provided by two entities. Telecom Canada, an unincorporated association of Bell Canada, the Government-owned Telesat Canada (a domestic satellite carrier), British Columbia Telephone, and other major carriers, provide public message switched and other toll service. CNCP Telecommunications, a partnership of the government-owned Canadian National Railways and the shareholder-owned Canadian Pacific railroad company, provides long distance data and private line service.

Competition in long distance voice communications has been limited by regulation. The CRTC in 1985, for example, did not approve a CNCP proposal to expand its offerings to include more than private line service. The CRTC reasoned that while competition might yield some benefits, the costs associated with reforming and rebalancing local service rates that are now heavily subsidized would be too great. The Canada customer-premises telephone equipment market is unrestricted, although the two leading firms, Bell Canada and British Columbia, are vertically integrated into manufacturing. Canada also has a high (17 percent) tariff on imported telephone products.

Intense economic regulation, some differences among federal and provincial regulatory authorities regarding their respective powers and prerogatives, and barriers to competition in equipment and long distance, all seem to have adversely affected the commercial growth of at least Bell Canada, the country's leading communications firm. Between 1986 and 1987, for example, Bell Canada's revenues rose only about 2 percent -- during a period when Canada's Gross National Product was increasing by 4.1 percent. Bell Canada's annual revenue growth appears to have steadily declined from 9.9, to 9.0, to 8.4 percent over the preceding years. Canada is one of the few OECD member countries today in which telecommunications appears to be growing slower than GNP. One might reasonably conclude that the Canadian regulatory and competitive environment is adversely affecting sector growth.

Conclusions

Many divergent factors typically bear on any country's telecommunications policies and developments. Thus generalizations are risky. Competition and less intrusive economic regulation, however, appear often, if not always, to have had a positive impact on telecommunications industry growth rates. U.S. communications policymakers frequently assert that competition tends to build these key markets. The available information lends empirical support to that proposition.

In the United States, annual telecommunications revenue increases reported for the regulated telephone companies alone have ranged from 9.2 percent between 1984 and 1985, to 8.2 percent (1985-86), 8.5 percent (1986-87), to a projected 8.4 percent for this year. U.S. Gross National Product growth during this period has been about 3.2 percent a year -- about the same as the average increase for OECD member nations. Between 1986 and 1987, our GNP grew by 3.4 percent. The competitive, less regulated U.S. telecommunications industry, in other words, experienced revenue increases that were about 250 percent higher than the increase experienced in the U.S. economy generally.

A similar situation appears to prevail in the United Kingdom. There, the trend line shows positive, with revenue growth averaging about 9.5 percent and increasing each year for the years following the Thatcher Government's privatization initiative.

In Japan, where strides have been made toward a more open and competitive market, but tight economic regulation of NTT and barriers to competition remain, the picture is less positive. NTT revenue growth, while higher than Japan GNP growth, nevertheless does not reflect the full stimulative effects of competition and deregulation.

The situation in Canada seems to indicate the adverse effects of overlapping federal and provincial regulation, stern controls of dominant incumbents, and persistent limits on competition. There, revenue growth for Bell Canada has steadily declined in recent years to the point that it was less than half the rate of increase in the Canadian GNP between 1986 and 1987.

The General Lessons of Two Decades of U.S. Telecommunications Policy Experience

Based on experience over the past 20 years, certain general conclusions can be drawn and forecasts made.

Substantial Change at an Exponential Rate

First, all indications are that changes in communications markets will continue to occur and, indeed, will do so at an accelerating rate. The first 45 years of U.S. telecommunications experience under the regulatory auspices of the Federal Communications Commission were characterized by continuity with some change. The succeeding nine years, however, have been characterized by change with some continuity. Change, not continuity, should prove the overriding communications industry reality well into the next century.

Four traditional underpinnings of the U.S. communications business -- the former Bell System and the three national television networks -- all experienced radical changes in the years since completion of the Rostow Task Force's work. In lieu of the Bell System, we now have eight major economic units, seven of which rank among the 100 largest corporations in the world measured by stock market valuation. National television network commercial hegemony is also progressively eroding in the face of continued growth of cable television networks, the video cassette business, as well as the development of independent television. Whether the common carrier, broadcasting, equipment, programming, computer-data processing or other pertinent sector is considered, the United States has progressed from concentrated and regulated markets dominated by a small number of firms to more pluralistic commercial conditions and significantly more competition, with less regulated or unregulated players.

In part due to the advantages afforded by computer and communications networks, the pace of change is also increasing, and seems likely to accelerate further. A prime example, as previously discussed, is fiber optic transmission technology. Previously it took about a decade for technology to advance from transmitting in the kilohertz range to the megahertz range, and another decade to move from megahertz ranges to gigahertz transmission. By comparison, we progressed from almost pure theory regarding communications via lightguides to having operational, nationwide fiber optic networks in only a little more than a decade and a half. Even faster changes due to the forecast introduction of superconducting technologies may be forthcoming.

In communications especially, specific estimates are subject to a risk of wide error. Based on past U.S. experience, however, one can say with high reliability that the exponential rate of technological change, and commercial exploitation of the results of research and development we have seen in recent years, should at a minimum continue and, more likely, accelerate.

Significantly, the many industry, academic, government, and other authorities with whom NTIA consulted in the course of preparing this report were in agreement on this point: that there would continue to be rapid communications industry changes. These experts differed in their assessment of the magnitude and timing of changes, as well as their enthusiasm for such likely developments. All believed, however, that change would continue to be a primary characteristic of virtually all significant domestic and international communications markets.

Diminishing Scope of Regulation

When the Rostow Task Force was deliberating, Federal telecommunications policies were the single most important factor bearing on the industry and its performance. Since that time, however, regulation and this part of the economy have become progressively decoupled.

Electronic home video entertainment services, for example, were almost exclusively offered by a small number of regulated television companies in the late 1960s, with total annual revenues of about $3 billion. Cable industry revenues amounted to less than $400 million yearly. Today, more than half the American households obtain video services both from the $30 billion a year, fully regulated television and the $12 billion a year, much less regulated cable television businesses. Additionally, however, an $11 billion a year video cassette sales and rentals industry has emerged almost completely outside the conventional regulatory regime. Markets such as the television receive-only (TVRO) satellite "dish" market have also emerged. There, not all transactions have yet been priced by the market; many TVRO owners continue to obtain value from the signals they receive without payment for them. The total electronic video services market, in other words, has increased more, perhaps substantially more, than sixteenfold in the past 20 years. But revenue growth has been much faster in the less regulated and unregulated submarkets which, today, constitute more than 45 percent of the total market (compared with not much more than 10 percent then).

Analogous developments can be seen in the common carrier communications business. At the time the Rostow Task Force was deliberating, fully regulated telephone companies constituted well over 90 percent of the demand for the pertinent telecommunications products. Since that time, however, regulated common carriers have been a diminishing telecommunications equipment market factor.

In 1985, for example, regulated common carriers providing public network communications accounted for about 59 percent of total equipment demand -- about $13.6 billion out of a total of $22.9 billion. In 1990, however, regulated carriers are estimated to account for about 55 percent of total demand of $30.6 billion. Regulated companies, in other words, over a five-year period are likely to account for about 4 percent less of a market that will expand by about 34 percent. They can be expected to account for about a 1 percent less share each year of a market which is expanding by almost 7 percent yearly. To the extent communications equipment purchases are a rough proxy for traffic and revenues, this implies the regulated part of the communications common carrier business should grow, but the unregulated part should grow substantially faster. It also suggests a majority of the growth in value-added services will be captured by unregulated enterprises.

An effect of these changes in telecommunications will be a decoupling of regulation from the marketplace, not unlike that which has occurred in the financial services sector. At the time the Rostow Task Force was deliberating, for instance, a great majority of the economic activity occurring in financial services involved fully regulated commercial banks, regulated securities trading companies, and the established stock exchanges. Since then, new less regulated enterprises including the commodities and futures exchanges, the over-the-counter and the "third market," as well as much less regulated financial services firms such as Sears and General Motors Acceptance Corp. (GMAC), have become much larger money market factors. A nearly unregulated multibillion dollar short-term commercial paper market has developed. Securities trading now occurs on a global market scale. The result has been, as the Brady Commission recently reported, that a progressively larger amount of total economic activity in the financial services field has emerged which is considerably less subject to traditional Federal Reserve and Securities and Exchange Commission regulation.

In telecommunications, this decoupling process has meant, in effect, that the amount of economic activity falling within the direct ambit of traditional regulation has declined, and is likely to decline even further. While deregulation of incumbent firms has proceeded gradually, moreover, the deregulation of the overall sector has moved significantly faster, because unregulated telecommunications enterprises have grown faster.

This is not to imply that regulated communications markets and companies today are necessarily at imminent risk. Clearly, this is a sector of the economy which has generally prospered and, indeed, experienced growth levels significantly above those of the economy as a whole. Profit levels, while not inordinately high, on balance, have been respectable. Nor does past experience necessarily imply a diminution in public welfare. To the extent new, unregulated enterprises satisfy customer demands, the public overall should gain and, at a minimum, incur no loss. Over the long run, however, and based on experience over the past decades, it is probable that the amount of economic activity in telecommunications represented by regulated companies will grow, but that the share of unregulated firms will grow progressively faster. The end result would be that, by the year 2000, regulators may have direct control over what at most will comprise half, and more likely, only one-third, of the total communications market.

Regulatory Difficulties

Over the past decades, new unregulated, or less regulated, communications enterprises have steadily gained in importance. With some minor exceptions, moreover, the overall scope of regulatory controls has remained and, in certain regards, declined. Incumbent telephone companies and television broadcasters today are not markedly less regulated than they were in 1970, although there has been some "de-thicketing" of regulation -- a "clearing away of the regulatory underbrush," as a former FCC chairman remarked.

Substantially more regulation has been lifted from radio broadcasting. Most significant, however, has been the rapid expansion of communications enterprises that, as an NTIA official recently commented, "are almost completely off the regulatory radar screen." Just as there are so-called "nonbank banks" in financial services markets today, communications markets are increasingly seeing what might be denominated "nonbroadcast broadcasters," or "non-telephone company telephone companies."

Traditionally, public regulation was pegged to concern over market dominance. The persistence of regulation notwithstanding the steady and substantial erosion of the monopoly position once commanded by established communications firms is thus not readily explained. Most likely, it reflects some reluctance to change or abandon familiar, comfortable regulatory practices, notwithstanding underlying marketplace developments.

At a time when changes are occurring in a variety of fields, this reluctance is understandable. U.S. economic strength, for example, was once so great both absolutely and relative to the rest of the world that public policymakers in a number of contexts have had difficulty adapting to today's far more globally competitive circumstances. Just as there is thus an understandable tendency on the part of Americans to assume, as previously noted, that the United States still stands as an economic Gulliver amidst a world filled with Lilliputians, there is an understandable tendency on the part of some regulators to assume that once plainly dominant companies such as AT&T and the three national television networks have the same economic power today which they previously enjoyed. The disorientation of regulation from marketplace realities has manifested itself in other ways, as well, however, as the traditional dividing lines between communications endeavors have been blurred by technology.

The 1934 Communications Act drew distinctions among categories of communications service which were based chiefly on the technologies then employed to provide those services. In the 1930s, telephone service was provided using wires, and broadcast services through radio transmissions. Although AT&T in the early 1920s had been engaged in broadcasting, moreover, by the 1930s broadcasting and the telephone business constituted distinct communities of interest. Service provision and ownership of communications facilities, moreover, were almost always linked.

Today, common carrier telecommunications is provided using a variety of methods, ranging from wire to microwave radio, satellite, and mobile radio. Video services are delivered by radio waves, but also by satellite, omnidirectional and other microwave links, coaxial cable, video cassette, and other mediums. While the telephone and broadcasting communities remain relatively distinct, there is progressively more blurring at the margins. FM radio subcarrier frequencies, for example, currently are employed as part of nationwide, satellite-linked paging systems. A limited range of carrier-like communications services are provided by some cable television companies; at the same time, there is increasing talk about telephone companies delivering "video dial-tone" or cable-related services to the home.

Additionally, a significant number of firms have emerged which provide communications and related information services but do not themselves own communications facilities. A majority of the companies providing long distance communications services today own few or no transmission facilities. Instead, capacity is leased from other carriers. In video services, program production, distribution, and ownership of broadcast plant similarly have diverged. A significant number of cable television networks have emerged that are unaffiliated with cable systems.

The rise of large multimedia enterprises, many functioning on a multinational scale, has also affected communications and its regulation. At present, about one-third of cable systems are owned or affiliated with newspaper chains which, in some instances, are also involved in conventional broadcasting and providing computer-related electronic information services as well. A significant number of cable television systems are owned by telephone companies, although the properties are generally not collocated. Large cable television companies have diversified into programming; major cable firms are also involved in the program production business. What once might have been inter-industry regulatory controversies have thus increasingly become intra-industry, indeed, intracorporate disputes.

The Rostow Task Force characterized the Communications Act of 1934 as affording regulators "near Constitutional flexibility." The FCC has thus proven able to adapt the broad language of the statute to new technologies and commercial environments. In some instances, however, regulatory difficulties have been encountered. An appeals court ruling in 1985 blocked FCC efforts to remove tariff regulation from nondominant communications common carriers. FCC sanctioning of common carrier-like use of FM radio subchannels was partly blocked on appeal where the court found a conflict with state regulatory restrictions on entry into the paging business. If broadband communications facilities to the home are deployed, difficult issues may arise regarding use of those facilities, given current restrictions on telephone companies to offer cable television and video services, and correlative restrictions on cable companies to offer telephone services.

In other countries, comprehensive overhauls of the prevailing telecommunications regulatory system have been undertaken. As indicated, the United Kingdom and Japan have done so, and a comparable effort is now underway in West Germany. Efforts to achieve such sweeping changes through communications legislation were pursued in the United States from 1976-80, but were frustrated by widespread opposition on the part of certain industry factions, and the general absence of the "crisis" conditions which increasingly have proven the best catalyst for Congressional action.

Experience to date suggests that the difficulties of accommodating the 1934 Communications Act (as well as parallel state legislation) to a more technologically and commercially variegated U.S. domestic telecommunications industry will grow, but that efforts to achieve comprehensive regulatory reform through legislation are not likely to prove successful. A result of this may well prove to be even greater participation by the judiciary in making communications policies.

New Regulatory Schemes

Relatedly, the past 20 years have already seen a rise in the decisional influence of the courts in telecommunications. Federal appeals court rulings played a major role in the removal of restrictions on pay cable offerings, the elimination of common carrier restrictions placed on customer-premises equipment choices, and the lifting of regulatory limits on permissible competition in interstate long distance telephone markets. Broadcast station renewal criteria were altered by the courts, and FCC rulings envisioning the dissolution of newspaper-television combinations upheld. Between 1974 and 1978, the court of appeals for the District of Columbia Circuit was a major factor, perhaps the principal factor, in telecommunications deregulation.

Since that time, the U.S. District Court administering the 1982 AT&T antitrust consent decree has become an increasingly pivotal player. FCC policy for some two decades has basically sought to foster maximum possible competition and greater, more efficient use of common carrier telephone plant. Since 1982, however, the consent decree court has pursued what the Department of Justice has described as a deliberate "quarantine policy" aimed at restricting the ability of the Bell companies, which constitute more than half the U.S. communications common carrier business, to compete.

Pulls and tugs involving the FCC, other regulatory agencies, and the consent decree court are increasing. The FCC and the Executive branch, for example, have determined that the participation of the Bell companies in providing new electronic information services is in the national interest. The consent decree court has continued to bar most such participation and only narrowly and rigidly circumscribed exceptions were made. The FCC and the Executive branch determined that the participation of Bell companies in manufacturing was in the national interest. The consent decree court disagreed and, indeed, strengthened existing decree restrictions. Additionally, that court has publicly assailed FCC programs to alter traditional telephone industry cost allocation and pricing practices, and proposals to remove economic regulation from effectively competitive communications services.

The increasing involvement of the judiciary as a major, determinative decisionmaker in this nation's communications policy has serious implications. The economic, technological, and analytical resources available to the courts is limited. The fact that courts rely chiefly upon adversarial processes may also create problems, as it may tend to inhibit the cooperative efforts that providing certain new services might require.

Judicial regulation already has slowed the advent in the United States of certain electronic information services, as a recent NTIA report shows. Many assume the AT&T consent decree court will itself eventually limit its restrictions on the Bell companies. Experience to date provides little basis to assume, however, that such changes will occur soon.

Conclusions

- Continuity with change has become change with continuity. Technology, demographics, competition, and Government action have speeded change in telecommunications markets. Consequently, traditional regulation and its assumptions have become increasingly obsolete.
- Most Government forecasts have underestimated the pace of growth and change. In instance after instance, Federal forecasts have assumed slower development, and more continuity, than experience over the past decades has shown.
- Competition builds markets; it does not erode them. The more competitive a given geographic, product, or national market, the faster it seems to grow. Competition thus seems key to sector development, and maintaining relative national parity.

- Increasing faction, coupled with multiple policy authorities, may hobble procompetitive growth. The active, ad hoc involvement of the courts and Congress may heighten uncertainties and impede otherwise desirable developments.

2

Perspectives on the Next Twenty Years

The next 20 years should see further major changes affecting almost all communications and information industries. Important demographic, technological, and commercial forces and developments will be mirrored in telecommunications and associated sector changes, as well as in government policies.

This chapter examines these likely developments. It also highlights resulting telecommunications policy priorities which are described in more detail in subsequent chapters.

Three Major Focal Points

The changes expected in the next two decades can be grouped into three broad categories: (1) those concerning business, industry, and the economy in general; (2) those bearing more directly on the character and quality of individual, community, and national life; and (3) those relating to our ability to influence economic change and quality of life goals. Within each of these three headings, moreover, there arises a fundamental and recurrent question. That is, given current trends and where, as a consequence, the United States is likely to be in the year 2000, what communications policy measures are needed to achieve desired goals and how do we achieve them in the most equitable and efficient manner?

Economic and Commercial Imperatives

Over the past two decades, economic efficiency and related commercial concepts have attained substantial public policy importance. The shocks of the 1973 Arab oil embargo and the hyperinflation of the late 1970s rippled across the American economic and political landscape. Increased international competition, and consequent changes in the way American business operated, compounded concerns about the country's economic future. Some observers contended we lived in a era of insurmountable limits and had seen the end of steady economic progress and increasing abundance. A result was increasing pressure toward a fundamental reorientation in U.S. economic and other policies.

Economic policy as it evolved during the Sixties had primarily emphasized management of the demand side of the economy. It viewed growth in supply as a relatively autonomous process governed chiefly by structural factors -- productivity and the size of the work force -- that were relatively immune to short-run government policy changes. Economic policy as it has evolved in the Seventies and Eighties, however, increasingly has focused also on the supply side of the economy, and the role of government policy as it affects supply decisions. Distributional economics, moreover, remain important. That is, national economic policy today, while emphasizing the possibility and importance of a progressively larger American economic "pie", also reflects concern over the relative size and distribution of the associated slices.

Current Strength of the American Economy

Sustained pessimism has been difficult to square with today's objective facts. While it is unarguably important that the United States must keep its economy strong -- to generate the jobs, investment opportunities, and capital surplus the country needs, and will need in the future -- by most criteria the U.S. economy is in good shape today.

Government initiatives, for example, have helped create some 17.5 million new American jobs over the past six years, more than the number created in Europe and Japan combined. The 1946 Employment Act and the 1978 Full Employment Act identified "good jobs with a future" as a national goal, and this mandate is being met. These new jobs, too, average some $22,000 a year -- compared with an average of about $19,000 a year for all existing positions. In short, more Americans are working today, and they are better paid.

Minority unemployment remains too high, but sustainable progress is being made. While employment has gone up about 15 percent overall, black employment has risen some 25 percent, and employment of Hispanics is up nearly 40 percent. More and more people, in other words, are being offered a chance to participate in building America's economic future.

There is also scant basis for claims that America is somehow "de-industrializing." The last five years have seen the longest sustained economic expansion this century. Real Gross National Product (GNP) rose 23 percent between 1982 and 1987. Real manufacturing output has grown faster, and now stands at close to its post-World War II peak.

The U.S. international trade deficit is still at unacceptably high levels. But by the same token, U.S. export performance -- particularly in high-tech trade -- has been good and is improving. Our office equipment and computer exports rose 64 percent between 1981 and 1986, for example. Pharmaceutical exports were up 41 percent. Overall, U.S. high-tech trade rose over 20 percent, even as total U.S. international trade dropped seven percent. Even in traditional heavy core industries such as steel, U.S. export performance improved markedly in 1988.

U.S. companies also have made many of the operational and other adjustments needed to remain competitive in an evolving world economy. Firms have "leaned-down" corporate overhead and modernized plants. American industry has adapted to environmental and occupational health and safety priorities which many countries and companies overseas are just now discovering.

There has also been significant progress made toward improving our national standard of living. The broadest measure of an economy's ability to support living standards is real GNP per capita. And, real GNP per capita rises when a larger fraction of the public is employed or when those who work produce more, or both. Not only do more people have jobs than ever before, but they have become increasingly more productive.

U.S. productivity gains lagged in the 1960s and 1970s, in part, due to an influx of less experienced workers. Between 1973 and 1981, productivity gains were minimal, but since 1981, real GNP per capita has grown at an annual rate of 1.8 percent, and this has helped make it possible for Americans to live better today. Total factor productivity in manufacturing has also generally improved.

Future Business Trends

Business-related communications and information usage and expenditures today reportedly represent some 60 percent of the overall market, and are growing faster than individual residential or noncommercial applications. Experts forecast this will continue. The efficiency and other gains associated with the increased application of information technologies, however, should affect various sectors of the business economy differently.

Retailing

Indications are that retailing and associated financial sectors may well be most affected. The infrastructure needed to support pertinent information services is almost fully in place today. For example, most major retailing companies already rely heavily on computerized point-of-sales terminals linked with sophisticated inventory and purchasing systems through communications. Several, such as Wal-Mart and Safeway Stores, have installed private, nationwide satellite communications networks. In addition, although a majority of financial services transactions today may still be accomplished conventionally, measured by number of transactions, and by dollar value, most today are handled electronically. Moreover, as the world's stock markets demonstrated in October, 1987, securities trading today is both global and essentially electronic. Information services, in short, have emerged and should become an increasingly important factor of production for retailing and associated financial services generally over the next few years.

Several demographic factors will contribute to this development. Because of low birth rates in the Sixties and Seventies, for example, the U.S. labor pool should be relatively smaller, and thus, some upward pressure on wages should continue for the balance of the century. Some labor economists believe immigration will ease possible shortages of skilled and professional workers, while more restrictive U.S. immigration laws could mean that labor shortages in less skilled positions will not be so readily alleviated. A relative scarcity of entry-level and semiskilled workers, which traditionally have constituted a large portion of the retailing work force, and higher wage rates for those hired, should give business an added incentive to automate electronically, which will mean an even greater reliance on information resources.

Yet another contributing factor will likely be the emergence of an aging, but more affluent U.S. population. The U.S. population on average has been growing older over the past two decades, and this trend is forecast to continue over the next decade. From a median age of 30 years in 1980, the United States should move to a median of 38 by the year 2000. While an aging population ordinarily implies a lessening of demand, particularly for consumer durables, housing, and some other commodities, the fact that disposable household income levels should be higher tends to offset such expectations.

Contributing to the expectation of greater demand (which probably will be reflected in higher retail and service sector sales) are other phenomena. As divorce rates have remained high, and the median age when individuals first marry has grown higher, the incidence of single-individual households, for example, has increased, and that trend is expected to continue. On average, these single-individual households should have substantial disposable incomes.

Relatedly, the number of two-income households should continue to rise steadily, as an increasing percentage of women seek work outside the home. If current trends continue, estimates are that between 65 and 80 percent of working age women will work outside the home by the turn of the century, compared with about 56 percent today. This trend, in turn, should place a premium market value on time-saving (and thus leisure time-maximizing) goods and services. To date, growth in retail electronic banking and mail order sales, for example, has closely paralleled the rise in the percentage of women working outside the home. Sales of consumer electronics such as microwave ovens, and surges in demand for convenience and fast foods, also reflect this change. Retailers in general can reasonably expect to employ information systems to meet this demand, both by offering "teleshopping" and similar services, and providing customers with new electronics-based product options, for example.

Manufacturing

International competition especially should continue to drive U.S. manufacturing toward increasing reliance on communications and information as a means of stimulating productivity, improved product quality, and innovation. Investment in "information resources" today, as earlier noted, constitutes about 24 percent of annual business equipment investment overall. The primary emphasis in recent years has been on more closely aligning product development, fabrication, distribution, and retailing and by so doing, improving the "through-put efficiency" of firms' overall production processes. Major reliance on computer-aided design, however, also is spreading. In this regard, auto, aerospace, and computer companies today are among the principal users of supercomputers for such purposes. Even in other much smaller and more traditional markets, however, computer-aided design is increasingly prevalent. Both vessels contending in this year's America Cup race, for example, were designed using the same computer software package. The improved management which the intelligent use of information resources allows, moreover, appears to have made commercial operation feasible on a broader scale, in other words, it has tended to raise the level at which any diseconomies of industrial scale and scope become a factor.

Changes in the automobile sector, which reportedly accounts for one in every six American jobs, show this new emphasis in practice. General Motors, for example, in recent years has moved to develop sophisticated computer and communications systems linking thousands of design and manufacturing facilities, retailing outlets, maintenance centers, and suppliers worldwide. Ideally, the new car purchaser in the near future will order a specific model, specifically equipped; that requirement will be entered into a communications and computer information system; requisite materials, in turn, automatically will be ordered from suppliers (or an existing vehicle in inventory meeting the demand located); production and delivery scheduling will then be accomplished in substantially less time. A primary objective is to reduce inventory and associated financing costs to a minimum. When serviced, moreover, centralized diagnostic systems will be increasingly employed on new cars. Manufacturer and dealer computers will be increasingly linked via communications. On-demand fabrication of special parts also will be feasible using computer-aided flexible manufacturing, thus sharply reducing delay and inventory costs.

More sectors of the manufacturing economy today rely on information systems to greatly reduce the amount of slack and downtime often characteristic of traditional production processes. An advantage has been to offset and help justify higher U.S. manufacturing wage rates; but the increasing reliance on computers and communications by foreign competitors has also made increasing automation by U.S. firms essential if they are to maintain their global competitiveness. Also contributing to demand, particularly for international telecommunications, has been the emergence of distributed global manufacturing by multinational corporations as a dominant commercial reality. Today, virtually all but the lowest value-added electronics products, for example, incorporate parts made in one country, assemblies and subassemblies produced in another, and involve final product fabrication accomplished in yet another. The same is true in the apparel, aerospace, and auto businesses. International telecommunications is essential to the smooth and efficient choreographing of such complex manufacturing processes.

In addition to these applications, U.S. manufacturers have made substantial strides in the use of communications and computers to facilitate the design of better products. By linking computers used in design and engineering via communications, the production of advanced, energy efficient jet engines, for example, has been facilitated. Without such "electronic tools," the necessary engineering and drafting tasks might well have proven impossible.

Manufacturing remains a cornerstone of the U.S. economy. Many of the highest value-added parts of the overall services economy -- producer services such as banking and finance, engineering, and the like -- are also heavily dependent on our domestic manufacturing sector. Manufacturing, moreover, is a sector in which investment in computer and related telecommunications products can be shown to have yielded commensurate productivity gains in the near term.

Greater reliance on information resources by U.S. manufacturing should generate a variety of spin-off effects. It will, for example, increase demand for higher skilled workers as well as necessitate further training of existing employees. Those are tasks which can be more efficiently accomplished, in turn, by using telecommunications, as indeed is currently the case. The depth and abundance of any given community's overall information resources portfolio should also play an increasing role in business plant siting decisions. In the past, it was the availability of transportation and labor resources, for instance, which often was decisive. Increasingly, the information infrastructure which a manufacturer requires should become increasingly significant in such facilities location decisions.

The availability of electronic information assets for business applications is likely to prove more critical. In addition, as telecommunications goods and services come to constitute a larger element of what constitutes a better standard of living, some employers may factor in employee access to the latest technologies when reaching facility location decisions. Similarly, as differentials between the communications and information choices in urban, suburban, and rural areas narrow, as they are likely to do, a dispersion of economic enterprises (as well as the revitalization of some now less prosperous areas) is more likely to occur, as more fully discussed in Chapter Four.

Service Industries

Information resources should also become an increasingly important production component for the service industries which today comprise nearly three-quarters of the U.S. economy. This growing reliance likely will prove a function, in part, of a relative labor scarcity and thus higher wage costs. It will also, however, reflect the fact that, in labor-intensive service sectors, telecommunications and computer services are among relatively few proven means of boosting productivity.

This reliance on electronic tools to boost productivity, while maintaining and improving product quality, should especially affect demand for radio frequency-dependent communications goods and services. Current services such as cellular mobile radio and paging offerings already are integral value-producing components of many service sector endeavors. As equipment prices continue to decline, and service costs fall as a function of greater communications traffic volume, mobile radio services stand to become even more ubiquitous. More intensive use of the radio spectrum, coupled with the larger commercial stakes of users, in turn should complicate spectrum management tasks and possibly move the current regulatory approach toward one that offers substantially greater flexibility and efficiency.

Telecommunications and information systems almost certainly will constitute a more important production factor in parts of the economy not typically regarded as service industries. Among the businesses most affected by these technologies, for example, have been printing and publishing. Virtually every major daily newspaper in the United States today is created and printed using computers, with many papers also operating satellite printing presses linked via communications in order to reduce distribution costs. The two largest U.S. dailies, the *Wall Street* Journal and *USA Today*, are prepared and printed on a national, indeed, international scale via computer and communications. Europe's leading financial daily, the London *Financial Times*, is also "imported" via satellite into the United States, just as *USA Today* is electronically "shipped" to Europe. Transportation, rail, air, and water carriers are already among the largest communications and information system users. Nationwide paging and satellite-based mobile radio should become increasingly important to motor common carriers as well, especially as higher energy costs and environmental concerns necessitate more efficient operations.

Not only will telecommunications and information thus constitute a larger factor of production for familiar and other service sector industries, but electronic information services themselves should become a substantially larger part of the U.S. economy. Remote-access data retrieval and data processing, interactive computer data bases, and so-called "electronic publishing" enterprises already account for some $4 billion in yearly revenues. Estimates are they will continue to grow at about a 20 percent compounded annually for the indefinite future.

Demand for such new services should swell, as a function of demographic forces. By the mid-1990s, at least one-third of U.S. households likely will be headed by computer-literate individuals. About 15 percent of American households have home computers today, and an increasing number of individuals make use of computers at their work place. In the past, individuals may have been reluctant to make the time investment needed to become computer-literate. For a growing number of Americans, however, the cost of acquiring knowledge and ability will shrink rapidly. Together with incentives to maximize leisure time through use of time-saving measures, a predictable result will be an accelerating growth of this information services sector, as more fully discussed in Chapter Five.

Ensuring the Quality of Individual, Community and National Life

In the final analysis, the strength of a country's economy is a principal determinant of the quality of its individual, community, and national life. Unlike some other nations, however, Americans clearly are unwilling today to subordinate many values to assumed economic and commercial imperatives. Public concern that a sound balance is maintained between business interests and social values, such as environmental protection, individual rights to privacy, equality of opportunity, and other attributes of a humane society, is strong today and will remain strong in the future.

Fundamental National Responsibilities

Fundamental national responsibilities with a direct and immediate effect on quality of life include defense and foreign policy which help provide for the safety and well-being of the country. A variety of other areas, such as transportation and education, have as a primary rationale the need for measures that will lessen regional and other disparities. In recent years, law enforcement requirements have also grown as drug abuse, potential terrorism, and other problems have arisen.

Defense and Related Applications

Telecommunications and information expenditures in support of national defense exceed $30 billion a year today, and almost certainly will remain one of the fastest growing components of our overall national security program. Since the Sixties, a fundamental assumption of overall national defense policy has been, as it is sometimes colloquially phrased, that if we cannot outbuild or out-man potential adversaries, we can certainly "out-smart" them.

This assumption is reflected in the enormously greater sophistication of current (and projected) weapons systems. It is also reflected in large expenditures for and reliance upon communications, command, control, and intelligence systems which seek to maximize the efficient use of defense resources, but place heavy demands on the radio frequency spectrum.

A major, if not often noted, recent accomplishment of those who manage radio spectrum has been the accommodation of both burgeoning civilian and steadily greater national defense and other Federal needs. This has been achieved, in part, through more reliance upon computerized signal processing; in mobile radio systems, for example, there is generally an economic trade-off between the sophistication of transmission and receiving equipment and the amount of channel bandwidth required. In addition, new, more efficient spectrum techniques have been developed (and, incidentally, also found growing commercial application); some "very small aperture satellite" (VSAT) systems, for example, are premised on this new spectrum technology.

Accommodating future demands, however, will require use of even more sophisticated, flexible, and efficient spectrum management techniques. Recently, NTIA, the Federal Government's spectrum manager, developed a new method for measuring the nation's finite spectrum resources. This Spectrum Use Measure (SUM) system represents a substantial contribution to the way this important natural and national resource will be managed. In addition, this work makes possible new ways of displaying radio spectrum use, such as the recent Spectrum Mapping Initiative which will make possible much more geographically precise radio use. This, as well as other developments seeking to harness the efficiencies inherent in computer and communications systems to heighten the effectiveness of overall radio spectrum use, will become increasingly predominant aspects of this resource management process.

Public and Related Services

Law enforcement challenges and associated government expenditures are generally a function of the size, diversity, and complexity of a society, and have been one of the fastest growing components of overall Federal, state, and local government expenditures since the 1970s. Forecasts call for the U.S. population to expand from about $250 million in 1990 to between $268 and $283 million by the turn of the century. As the size and composition of the American public changes increased law enforcement responsibilities will arise.

The size and complexity of the U.S. economy should also tend to boost outlays for other public services, such as air transportation. Domestic passenger boardings have increased exponentially since airline deregulation in the 1970s, and all indications are that reliance on air transportation will continue rapidly to increase. Additionally, business and industry dependence upon air cargo services should continue to surge. Since the 1960s, a primary factor contributing to the breakdown of traditional geographic barriers that previously affected the scope of commercial enterprise has been the advent of an efficient air transportation system (and another major factor, of course, has been the parallel development of the national telecommunications system, with the appearance of 800 toll free and similar offerings and the sharp, steady reduction in toll service prices).

Both law enforcement and commercial aviation constitute major sources of demand for telecommunications and information services. As more fully discussed in Chapter Five, increasing demand for telecommunications and information services to function as a component of an overall local, state, and regional surface transportation management program is almost certain as well. To reduce commuter congestion, for example, Chicago, Los Angeles, and Washington, D.C. metropolitan area authorities already are employing computer and communications-dependent traffic control systems. Perhaps the most sophisticated such system currently is operational in Hong Kong. There, roadway sensors identify each vehicle's electronic "signature," and fees are then automatically computed and assessed depending on time of day and location. As traffic woes increase worldwide, and environmental concerns also rise, the proliferation of similar and other traffic management tools seems very likely. No experts forecast that the international public appeal of the automobile will dissipate; consequently, more sophisticated, communications-rich systems for managing use of motor vehicles will be needed, both here and abroad.

Ensuring Improved Educational Opportunities

Substantially greater reliance on telecommunications and information services by the educational community also is likely, both to deliver primary, secondary, college, and post-graduate or adult education as well as to aid in teacher training. Additionally, business education and training expenditures, which already slightly exceed public educational outlays in aggregate, are likely to grow.

U.S. education today confronts special challenges. Although total outlays are still rising, as noted in Chapter One of this report, the so-called "birth dearth" is having an effect in terms of overall taxpayer support. As the number of taxpayers with children declines, resistance to increased educational spending has materialized in many states -- a function of the truism that those who neither consume nor perceive of themselves as directly benefiting from some government expenditures tend not to support them. At the same time, however, education costs are rising.

Coincidentally, the responsibilities placed on the U.S. educational system are growing. Science, mathematics, technical, and other education and training have never been more important when it comes to securing a good job with a future, and thus being able to participate fully in our national life. The knowledge and acculturation experiences provided by public education will be steadily more important as immigrants and minorities come to comprise a larger part of the overall population. The European-heritage population is projected steadily to decline to about 55 percent of the public from 70 percent today, as the black, Hispanic, and Asian-American population grows. Urban school administrators already speak of the traditional American "melting pot" becoming more of a "salad," comprised of relatively distinct populations and cultures. Concerns regarding English language literacy are widespread today and should continue to grow. The public education system in this country has always been on the front line of social change, and will continue to try to meet these challenges. Absent the leverage afforded by new technologies such as telecommunications, however, fulfilling that important task may become progressively harder.

Contributing to educational challenges is both a current scarcity of teachers in certain disciplines, and increasing competition for teaching personnel on the part of the business and industrial sectors. Improved teacher salaries, greater recognition of the critical role public education plays, and the training of more teachers may help alleviate this problem, but it will take time. Telecommunications offers a cost-effective means of meeting many of these current difficulties, as discussed more fully in Chapter Five, and should aid in reducing many long-range problems in this area.

Telecommunications also provides a cost-effective means of spreading scarce educational resources more equitably. Particularly in some urban and rural areas, there are scarcities both of teachers and financial resources. Unaddressed, this differential could have substantial adverse implications. Among other things, it tends to accelerate the concentration of the population in already congested urban areas. At present, some 78 percent of Americans live in metropolitan areas; 100 million of a total population of about 248 million, or more than 40 percent live within 50 miles of our coasts; some 90 percent of Americans also reportedly live on less than five percent of the country's land area. A decision not to work for a more even and equitable geographic distribution of services, business, and employment opportunities thus is tantamount to a policy favoring further population concentration, and the associated pressures on the natural and economic environment. Because telecommunications makes distances less important, it facilitates the more geographically widespread distribution of opportunities. While only part of any overall approach, it may nevertheless constitute a significant component in any remedial equation.

Fostering Employment Mobility

For the remaining years of this century and continuing into the next, employee training and retraining will likely gain in priority. In addition to the obvious need for entry-level workers to learn tomorrow's necessary job skills, and current employees to stay abreast of developments, developments in the economy imply a growing need to retrain workers in their forties and fifties.

In the 1970s and 1980s, the "leaning down" of many major corporate work forces was often accomplished by affording current workers early retirement. An effect was to expand promotion opportunities for younger workers. Some contend the United States can no longer afford the luxury of diminishing work, or capital generating, personnel rosters while steadily expanding income support, or transfer payment, rolls. Given the knowledge and skill levels of older workers, moreover, early retirements can implicate an unacceptably high cost to this nation in terms of lost opportunity. One of the principal strengths of the United States has long been its highly skilled, motivated, and productive work force. This represents a first-order national resource, and ensuring its effectiveness and efficiency is thus important to the economic future of the country.

It is expected that workers will seek expanded choices which include not only early retirement but also the option of continuing to work in non-traditional alternative ways. As discussed in Chapter Five, telecommunications and information systems will not only make many of these alternatives such as working in the home (i.e., "telecommuting") possible, but could also make retraining more feasible. An electronically-assisted educational infrastructure which could be used for traditional primary-, secondary-, and college-level instruction, furthermore, could also yield additional public dividends in terms of furthering better and more widely available adult education and career alternatives.

Expanding News, Information, and Entertainment Options

A consequence of the massive national investment in education, commencing in the immediate post-World War II period and extending through the establishment of community colleges in the Sixties and Seventies, has been steadily to raise the median educational level for the United States. The median, at 12.6 years of formal education, is one of the highest levels in the world. This, in turn, appears to have positively affected the appetite of the American public for news and information, as the increasing audiences and profitability of local television station news, among other things, suggests. It has also stimulated demand for higher caliber of cultural entertainment, as growing theatre, symphony, and public television audiences attest.

All indications are that general demand for these entertainment services will continue to grow through the balance of the century. Some forecasters also believe that demand for delivery of these options to the home will grow, partly because of work place trends, which typically today see both spouses working a somewhat longer work week outside the home, a trend which may mean a greater desire for in-home alternatives. In concept, new communications media make "narrowcasting" more economically feasible. Indeed, multichannel mediums such as cable television already show a considerable diversity of program choice. Thus, as more fully discussed in Chapter Eight, there is ground to project that "narrowcasting" by the turn of the century will be a commonplace, and commercially rewarding, phenomenon.

Safeguarding Individual Privacy

Coincident with the expansion of communications and computer facilities and uses, we are likely to see growing public concern that reasonable means of safeguarding individual rights to privacy be identified. Following the Watergate and associated disclosures, privacy was the focus of a Presidential study group in the United States, as well as related privacy protection initiatives undertaken in Europe. A variety of Federal and state laws (many of which are not termed "privacy protection" statutes, although that is their effect), together with strong U.S. industry support for the privacy protection principles adopted with U.S. Government support by the Organization for Economic Cooperation and Development in 1980, have met many previous concerns. As public awareness of the growing scale and scope of information maintained and used, particularly by the private sector, increases, however, so too will concerns for maintaining or establishing workable safeguards. This is more fully discussed in Chapter Seven.

Meeting Health Care Needs

Experts maintain that the U.S. health care system today is oriented more toward meeting acute care needs through hospitalization, while the health care requirements in the future are more likely to involve preventative and longer-term chronic care medical services. Compounding health care challenges is the aging U.S. population, as well as the sheer cost of the current system.

So-called "telemedicine" and similar health care delivery modes appear increasingly attractive to funding today's medical system. Because telecommunications-assisted health care appears more cost effective, as well as better able to provide services keyed directly to preventative and long-term care needs, such an approach seems highly likely to be pursued on a broad scale in the years to come.

For an aging population, such an approach offers alternatives to costly and depersonalizing institutional care, making possible delivery of health care services in an individual's home. While not a substitute for current health care delivery systems, such telecommunications-dependent systems constitute a potentially valuable supplement, as demonstrated more fully in Chapter Five .

Harmonizing National Communications and Information Policies With Priorities in Other Fields

As telecommunications and information services become integrated into an increasing array of commercial and other processes, new challenges and opportunities can be expected to arise These new technologies will improve the efficiency and effectiveness of the processes that incorporate them. By the same token, inefficiencies which remain in the telecommunications and information sectors through such things as unnecessary government regulation will have greater potential to ripple throughout the economy. The challenge for public policymakers, therefore, is to maximize the society's ability to capture the benefits of these technologies.

Managing the Transition to Effective Competition

Many U.S. telecommunications markets initially developed under government policies which assumed a need for monopoly, albeit regulated. Consequently, a number of industries were provided with government protection when competition emerged. This was particularly true in domestic common carriers, but was true in other industry segments as well. Policies were adopted which, if not explicitly protectionist, nevertheless had the practical effect of shielding incumbent firms from the full rigors of competition by new entrants.

Today, those earlier policies are being reexamined. Regulators and policymakers have asked whether it is appropriate to continue to provide special treatment to specific competitors. Some economists have contended that earlier policies designed to minimize the risk of below cost pricing, for example, are not needed in markets where costs are declining and expected to continue to decline substantially. They maintain it will be increasingly impossible for firms to recoup short run losses incurred through below-cost pricing in the face of open-entry.

While removing regulatory barriers to price competition is desirable, it is important that it be accomplished in a fashion conducive to maintaining the current consensus in favor of marketplace solutions. "Flash-cut" deregulation may appear economically efficient on paper, but concern with both the perception and reality of transitional equity is important as well. If firms within a given industry believe that commercial conditions are generally predictable and fair, and that customer responsiveness, investment, and research and development into new products can be rewarded, Americans will continue to support reliance on competitive markets. If people feel, however, that competitive conditions are unpredictable, or that success or failure in the market will be dependent chiefly on the ability to manipulate government policies, then the free market conditions underlying our nation's growth and prosperity will be threatened.

At present, several government organizations affect national communications policy. No single entity, however, has the absolute power or discretion to impose, or unilaterally sustain, its own solutions. If regulators take actions over the strong objection of any one industry group, for instance, the likelihood of Congressional intervention is heightened. Our multifaceted communications policy system, in short, contains a number of checks and balances.

Over the next decades, those responsible for U.S. communications policy will encounter increasingly crowded waters. As more commercial and other processes incorporate telecommunications and information services, the number of Congressional, Executive branch, and private sector "stakeholders" (or perhaps more accurately, "brakeholders") with an interest in the outcome of any given controversy will grow. This will require closer attention to the communications policymaking process by those involved in it. Regardless of whether wholesale changes in current laws or institutional arrangements are accomplished, which most believe is unlikely in any event, it will be ever important that those accorded policymaking authority have considerable understanding of the communications and information industries and a sophisticated grasp of how government works.

Allowing Private Enterprise to Work

Over the next decades, U.S. communications and information industries will confront increasing competition, both at home and abroad. Traditional policies that rested on the assumption that the size, scope, and structure of U.S. firms alone determined market competitiveness will increasingly be reappraised in light of this development.

In a market characterized by dynamic technology, rapidly proliferating demand, and global competition, the public interest will best be served by affording the private sector discretion to determine optimal company size and scale. Those in the market guided by profit incentives, and subject to market discipline, have typically proven better able than government decision makers to resolve these questions.

This will likely cause to continue the ongoing reappraisal of existing rules and regulations that seek with considerable particularity to dictate the businesses which certain companies may enter and exit. In general, policies that permit independent, *de novo* entry by any firm into any line of business, and regulate entry through merger or acquisition according to antitrust standards of general application, seem preferable to continuing special regulatory and other legal restrictions. Examples would include the laws that bar national television networks from owing cable television systems, or those which meticulously delineate the permissible activities of the Bell operating companies. Where such restrictions cannot reasonably -- or equitably -- be rescinded, an alternative may be to establish a series of dates certain after which these special restrictions will be removed, and general safeguards applied instead. We should, in any event, continue to work toward phasing out special impositions where there are no clear and compelling reasons for maintaining them.

In addition to reassessing the wisdom of artificial regulatory and other restrictions on commercial decisionmaking, policymakers should reexamine traditional assumptions regarding "market failure." Traditionally, special subsidization and other schemes have been premised on assumptions that an unregulated marketplace will neither produce nor equitably distribute certain publicly desirable goods. The United States has long assumed, for example, that significant subsidization of local residential telephone service is necessary (as have most other developed countries).

The development of new communications and information services, and projected traffic growth, may radically alter the traditional cost equation. The United States has achieved universal penetration of television service, as well as, more recently, near-universal availability of cable television and video cassette recorder options, without resort to the elaborate intra- and interservice and customer subsidies characteristic of telephone service today. In the case of television, cable television, and VCRs, there has been no "market failure," as that term is generally defined (although there has been significant regulatory failure, particularly with respect to the cable franchising process). Over the next few years, the government should reexamine the premises underlying regulation in other areas and be prepared to make necessary changes. This is addressed more fully in Chapter Three.

Fostering Innovation

America's strength, as the late Commerce Secretary Malcolm Baldrige often noted, has been both our technological edge and our ability to bring technology-rich products to the market. While government has taken steps in recent years to facilitate research and development -- through legislation (such as special tax credits) and by somewhat relaxing traditional antitrust limitations -- more needs to be done in the telecommunications and information industries. Increasing pressures in this regard are highly likely.

Telecommunications and information services are increasingly global markets. The principal Japan and Europe-based companies with which U.S. firms compete currently benefit from both substantial direct government support as well as far fewer constraints on joint activities. Consequently, any U.S. policies that hobble American companies' efforts jointly to develop countervailing commercial expertise and sales power could have the practical effect of relegating our firms to second or third-class competitive status.

Ensuring Universal Opportunities

Communications policies should ensure that Americans are not denied the service and price choices currently enjoyed. The Federal Government has stated its commitment to maintaining the universal availability of basic telephone service, for example. This should remain a cornerstone of national communications policy. It may well be, however, as more fully developed in Chapter Three, that this commitment will be better fulfilled in years to come by eliminating current restrictions on industry than by instituting new subsidy programs.

For example, if greater commercial use of existing and future facilities were not only permitted, but encouraged, telephone companies might have a positive incentive to maintain and extend service in all perhaps remote rural areas. Removing current judicial restrictions, therefore, promises not only to aid in fulfilling existing policy goals, but also to extend to more Americans a broader range of communications and information service choices.

Promoting More Market Symmetry

Telecommunications trade concerns already have prompted passage by Congress of special legislation aimed at expanding market access for U.S.-based companies abroad. While this measure should have some positive effects in terms of reducing the annual rate of deficit growth in this sector, all indications are that telecommunications trade issues will remain a significant component of the public policy agenda.

Achieving greater market access parity is important if U.S. companies are to maintain technological leadership in this key high-technology area. At the same time, it is important that U.S. policymakers not hamstring U.S.-based communications companies by placing on them obligations which are not also imposed on their foreign-based competitors. These matters, and other critical international telecommunications and information industry matters, are addressed in Chapter Six.

Priority of Economic and Development Issues

Strengthening the U.S. economy, and ensuring that it will continue to generate the capital surplus needed in support of substantial national needs, will grow as a priority public policy concern.

That overall efficiency and competitiveness matter is increasingly obvious to a majority of the American people. Most political leaders, and most of the public, from all parts of the political, social, and economic spectrum, seem now to agree that the balance of this century will see the United States engaged in competition worldwide for capital, jobs, and investment opportunities. That telecommunications and information resources can play a major role in furthering efficiency and competitiveness, moreover, is also becoming much more widely appreciated. This is reflected in actions by state and federal regulatory authorities, commendable recent policy statements by the National Governors Association, and the comments of important Congressional leaders.

Over the balance of this century, the United States will also face a number of internal challenges, in addition to competing more effectively relative to other nations. These domestic challenges range from rebuilding and expanding the physical infrastructure, meeting different and, in some regards, greater social and health care needs, and more efficiently delivering basic education and training services. Meeting these challenges will require a strong economy, which, as the discussion in Chapter Three points out, telecommunications and information services can help ensure. It should also entail the creative application of these particular technologies, which means that more and better "electronic tools" should be made more widely available.

Communications and information services are not *the* national panacea. They, however, are a major part of any solution, and a part which government policy directly and significantly affects. Government has relatively few tools available by which it can directly increase industrial productivity, or greater personal savings, or more capital investment. It has a number of policy tools readily available, however, that have a direct bearing, for good or ill, on the country's store of communications and information resources.

Associated Public Service Concerns

With likely future industry changes, and greater emphasis on commercial development, there likely will arise anxiety in some quarters regarding perceived adverse affects on familiar institutions and the noncommercial or "public interest" services they are believed to provide. There will likely also be concern voiced regarding access to the capabilities associated with new communications and information technologies. A number of recognized experts have raised legitimate questions such as if, for example, "computer literacy," or the ability to access and use electronic information services, becomes a critical component to ensure an individual's ability to participate and contribute to society generally, it is reasonable to ask whether special policies are needed to promote that literacy, that access, and that ability to use tomorrow's "electronic tools." This is elaborated on in Chapter Five.

Such concerns, of course, are not new. From the inception of the telecommunications industry, concerns have been raised regarding the distribution of services. U.S. competitive and deregulatory experience, however, is inconsistent with "static pie" assumptions. Instead of eroding markets, experience indicates competition and deregulation typically spur their growth. With that growth has usually come more widespread dispersal of benefits, not less.

Markets also ordinarily are enormously resilient, able to evolve mechanisms that will ensure that most needs are met. Telecommunications history provides few instances in which competition has meant the demise of an existing service. Television did not lead to the demise of sound broadcasting, for example. What did occur was that some of the competitive advantages enjoyed by radio broadcasters were eroded. At the same time, radio adjusted and provided new services to its listeners.

Some nevertheless continue to express concern that "excessive" competition may impair service as it is now provided to certain geographic areas and user groups. Such concerns must necessarily be recognized and addressed. The focus should be, however, on means of continuing to assure that public interest requirements are fulfilled while, at the same time, the public and the U.S. economy at large are permitted to capture the economic and innovation gains associated with less regulated, more competitive markets.

Through measures such as the FCC's "universal service fund," means have been established to safeguard legitimate transitional equities. As the pace of change gets greater, the need to devise comparable safeguards, and the difficulty of implementing those safeguards, seems likely to grow. The lesson of the past 20 years in communications, however, is that efforts to hobble competition usually, if not always, prove unsuccessful in the end, while imposing substantial direct, opportunity, and transactional costs. By comparison, efforts to safeguard clearly defined public interests, while at the same time allowing maximum competition, have typically succeeded.

The government sought for many years to restrict telephone equipment competition. A result was to deter investment in U.S. manufacturing facilities by companies other than AT&T. When restrictions were ultimately lifted, we lacked sufficient diversity of indigenous manufacturers. That contributed to some of the deficit we experienced subsequently; U.S. entrepreneurs joint ventured with firms based in Europe and Japan because, at the time opportunities were expanding, they had relatively few alternatives. Had we acted sooner to foster a strong, diverse domestic manufacturing base in this regard, some subsequent adverse effects might have been avoided.

Similarly, the government sought to regulate cable television for many years, on the ground it would "fractionate" audiences and "siphon" programs from "free" television. An effect was to limit the public's alternatives. Another effect was to diminish competition within broadcasting. When cable restrictions were lifted, an effect was to stimulate the growth of independent, UHF television stations for which cable retransmission meant delivering a signal technically on a par with established VHF stations.

In the future, in short, we should trust more in the effectiveness of less regulatory more market-oriented solutions. For experience demonstrates that almost always has yielded positive public policy gains.

A More Holistic Approach

As communications and information goods and services increasingly constitute a component of a broadening range of commercial, educational, and governmental service enterprises, establishing sound policies and making good choices should depend more and more on the breadth of the policymaking perspective brought to bear. This, in turn, should oblige communications policymakers to take into account effects not only internal to the communications industry, but also on a broad range of other interests.

The current government policymaking process incorporates many participants, but the absence of centralized direction and control is often apparent. Here, as in other areas, of course, where all appear, or pretend to be in control, none usually are. An undesirable consequence may be to heighten unpredictability and uncertainty, with resulting adverse effects on business and capital markets. Another consequence may be to minimize institutional accountability, and compromise the ability of Congress and others to assess what has been accomplished and needs to be done.

Pluralism and diversity count as strengths of the U.S. government's processes. Our diverse and variegated communications policymaking community, moreover, finds many parallels in other governments overseas. Excessive pluralism of policy views, however, coupled with a more diverse range of issues and concerns, may prove a significant detriment. This is particularly likely if an entity with primary coordination and policymaking responsibilities is lacking in institutional strength. Experts today thus question whether the United States can continue to afford the luxury of communications policymaking and implementation as practiced in the past. As the range of affected national and international interests grows and the risk of making wrong decisions becomes more apparent, pressures to develop a better means of making and implementing communications policy will likely continue to increase. Chapter Nine looks at this subject in more detail.

Sir Winston Churchill, once eloquently differentiated between the beginning of the end, and the end of the beginning. Many of the major changes experienced in the telecommunications industry over the past 20 years have occasioned dire predictions regarding the beginning of the end of a sound system. It is now apparent, however, that the past two decades actually represented the end of the beginning, and the commencement of what, with sound policies, should prove both an exciting as well as a socially and economically constructive era.

Conclusions

- o Faster growth on the part of less-regulated and unregulated sectors will mean less and less of total communications market economic activity will come within the direct control of traditional regulation.
- o Developments will diminish chances of "market failure." Decreasing costs and increasing capabilities will reduce the need for government intervention to compensate for "market failure."
- o Increasingly sophisticated business and residential markets will demand more and different options. Telecommunications and information services

the advent of widespread computer literacy, plus demographic changes, will drive individual demand as well.

- Telecommunications and information services will become even more important to our international trade and competitiveness, and market-based solutions are most likely to ensure the strength and robustness of this critical high-technology sector.

3

The Telecommunications Infrastructure and "Universal Information Service" in the Year 2000

For more than 50 years, a guiding public interest principle for U.S. telecommunications policy has been "to make available . . . to all people of the United States a rapid, efficient, nation-wide, and world-wide wire and radio communication service with adequate facilities at reasonable charges." Over the years, this language from section 1 of the Communications Act of 1934 generally has been interpreted as the basis for the goal of "universal" basic voice telephone service.

While ensuring affordable access to basic voice telephone service should and will remain a public policy commitment into the 21st Century, expanding telecommunications capabilities and the increasing importance of such new services to the economy and American society raise two important questions. These questions were the subject of much comment by those attending meetings with NTIA during this project: first, whether traditional concepts should evolve to mandate a broader "universal information service;" and, second, whether special government steps are needed to accomplish that goal.

The Promise of Technology

Given current trends, the 21st Century holds the promise of a highly enhanced telecommunications and information infrastructure, capable of more effective delivery of familiar as well as new telecommunications and information services by both traditional companies and new entrants. The continuing evolution of the United States to a service- and information-oriented, and more mobile society, moreover, should also continue to stimulate demands on the telecommunications infrastructure for these more innovative services.

In fact by the year 2000, we might enjoy being part of an electronic "national neighborhood," or even "international neighborhood," connected by several alternative telecommunications and information systems which blend voice, data, and video communications. The existence of such an electronic neighborhood could allow people to share interests, hobbies, and information. An AIDS victim could share feelings and helpful information with other sufferers; stamp collectors could get together and particularly unusual items could be offered on national or international markets to prospective buyers; members of a family, who in the past would have lived near one another in a traditional neighborhood, could more readily exchange information or enjoy a more personal video telephone call. In short, as technology creates new services, and competition drives prices down, the prospects for a national or even international electronic neighborhood become greater.

Additionally, under these competitive conditions, and through integrated services digital networks (ISDNs), direct broadcast satellites, terrestrial broadcast subcarriers, or even other as yet unknown technologies, a gifted teacher in California could simultaneously tutor children in Pennsylvania, Florida, and Wyoming. A student doing research in Baltimore could, in real time, contact other students, teachers, or libraries anywhere in America to exchange ideas and insights as a matter of course. Doctors could instantaneously confer on a patient's health from remote locations and have direct and immediate access to all information needed for diagnosis, almost as if they were together in the same hospital office or laboratory. A person living alone needing emergency assistance could press a button in order to convey not only the need for help, but also all needed critical information on location, medical history, and condition. A displaced worker could learn new skills at home. In a nation brought together by satellites, fiber optics, and digital switches, distance, time and economic barriers could be rendered substantially less important.

Fostering Efficiency

Because technology and competition are yielding steadily greater capacity at diminishing unit cost, there is clear potential for greater efficiencies in the provision of communications and information services. At present, about half of the total intercity communications network, for example, is composed of very high capacity fiber optic cable. Multiple routes exist between many points, increasing reliability for those customers utilizing more than one vendor. Over 80 percent of the switching capacity used is electronic. AT&T, moreover, maintains that most of its transmission and switching systems will be digital by the early part of the next decade.

Changes have occurred less rapidly in local exchange plant. Current projections, however, are that not later than the mid-1990s, if not well before, the cost of installing fiber optic cable in the local telephone system should be less than the cost of coaxial or traditional "twisted pair" copper wire. Existing local exchange company investment in conventional plant also should be largely amortized. The incidence of local digital switches, currently about 40 percent nationwide, should be much higher. More efficient local transmission facilities and digital switching should lower the long-run marginal costs of providing both conventional and new services, such as "video dial tone," a concept recently discussed by NTIA in its 1988 video study, whereby a broad range of video, audio, and data services would be available on demand. In addition, in locations where competition develops and more than one network exists, reliability will be increased for those customers utilizing more than one vendor. The large economic loss and inconvenience caused by an incident like the service-interrupting fire in the central office of the local telephone company in Hinsdale, Illinois, in May, 1988, could be substantially reduced or avoided.

Reducing Traditional Boundaries

Technology offers a means of breaking down cost and geographic barriers which traditionally have made the provision of service to certain communities economically prohibitive. Expected innovations such as the development of remote message traffic concentrators and digital radio systems should make the delivery of voice and other services to remote areas commercially feasible. With approximately 500,000 American families living in remote rural areas which lack the option of even basic telephone service, digital radio systems can make an important, immediate contribution toward further expanding universal service and bringing rural areas into the "national neighborhood."

Technology and resulting cost reductions should also make both new services and additional local competition possible. As with telephone service, geographic and cost constraints historically limited the provision of video programming services in certain remote areas. Due to developments in technology such as television receive-only (TVRO) earth stations and video cassette recorders, individuals in remote areas now have access to many of the same entertainment choices available elsewhere. In the future, reductions in both the size and cost of satellite terminals should make such products even more attractive for the provision of both entertainment and non-entertainment services, such as health care and education.

Linking Communities

As some of our leaders have noted, the United States constitutes a nation of communities. Telecommunications and information offer opportunities to bridge geographic and economic barriers, and create the electronic "national neighborhood."

This may prove particularly important given current demographic trends. The United States is becoming even more culturally and economically pluralistic. Moreover, ours remains a highly mobile society, a phenomenon which will continue to affect family, community, and other relationships. It is thus important that there continue to be effective and, optimally, improved means by which all citizens, irrespective of geographic residence, social, economic, or educational attainment can share in common national experiences.

Television has long provided news, information, and entertainment that is experienced simultaneously by many people. It has been an important tool in encouraging acculturation. The telecommunications infrastructure of the 21st Century will have the potential to allow improved interaction among many people.

This potentially could yield important public and national dividends. At a time when participation in fundamental political activities, such as voting, continues to decline, better communications and information services could afford expanded access to information regarding public and educational services, and stimulate public participation in local, state, and Federal government. Such electronic networks could facilitate personal contact within affinity and interest groups; already there is a proliferating diversity of computer bulletin board and similar interpersonal networks. Information networks could also expand the advertising options available to businesses and the public. In short, as the electronic "national neighborhood" materializes, it will hold real promise for people looking for support, encouragement, or sharing.

History of Our Universal Service Commitment

The United States, as is true of most other countries, has a tradition of government support for the development of efficient, ubiquitous communications systems. The U.S. Constitution, for example, demonstrates the importance initially accorded the development of a ubiquitous, paper-based communications system. It specifically authorized establishment of a postal service, to foster commerce as well as promote the social and cultural life of the nation.

Linking Businesses, Individuals, and Communities

In the early part of this century, increasing business and public reliance on electronic voice communication engendered a national desire for universal telephone service. Through the early 1930s, the percentage of small businesses and households subscribing to telephone services grew, but in percentage terms remained relatively low. In recognition of the growing importance of such services to the American economy and society, however, explicit policies were incorporated in the 1934 Communications Act directing the FCC to make such voice communications services universally available.

The Communications Act specified no single means of accomplishing this goal. It was furthered by the development of a system of internalized cross-subsidies at the Federal and state levels. They had as their fundamental objective helping to keep rates for basic local residential service low. In 1949, moreover, Federal legislation was enacted directly to subsidize extension of telephone service in rural areas.

Success of Traditional Policies

These efforts succeeded. As of 1988, basic telephone service was available to nearly all households in the United States, and approximately 93 percent subscribed. Since the value to users of any interactive service is reflected, in part, in the number of subscribers who can be reached on the system, the achievement of what is generally regarded today as universal telephone service substantially contributed to the national economy and general welfare. From both a technical and service perspective, basic telephone service has also improved continually in most areas of the country, from multiparty to single party service, from rotary dial to touchtone, from operator-assisted to direct long-distance dialing. In addition, the introduction of advanced electronics into the local telephone exchange network, which began almost exactly 20 years ago, has brought customers many additional services such as call forwarding, call waiting, speed calling, and three-way calling.

Necessary Action Steps

In light of the possibilities for new service offerings by the 21st Century, as well as the growing importance of telecommunications and information services to U.S. economic and social development, limiting our concept of universal service to the narrow provision of basic voice telephone service no longer serves the public interest. Added to universal basic telephone service should be the broader concept of universal opportunity to access these new technologies and applications.

Barriers to such expanded access exist today. Inefficient and unwarranted regulation, for example, has tended to discourage investment in public network facilities, and has been partially responsible for the development of private communications systems. While meeting specific users' requirements effectively, such private systems may not produce the overall national gains which an expansion of public network options could yield. Marketplace efficiencies, not unequal regulatory treatment, should determine usage of public and private systems. Additionally, there remain legal obstacles to competition. Some state and Federal policies today effectively limit local exchange telephone companies (which provide the public network) to the provision of basic voice and some data service, while also effectively limiting cable television companies to mostly one-way video entertainment. De jure and de facto monopolies exist for both local telephone and cable television service, thereby depriving subscribers of the benefits of competition available to long-distance customers and equipment buyers.

Local telephone rates have been artificially depressed through extended depreciation schedules and cross-subsidies from long-distance, local business, and so-called "vertical services" (e.g., call waiting). This may produce short-run advantages for current residential telephone subscribers, but at the expense of future users, while also imposing increasingly high opportunity costs. While movement toward the "information age" almost certainly will continue, the continued lack of competition and application of traditional cross-subsidy measures may have the effect of increasing the cost and delaying the arrival of a more feature-rich telecommunications and information services infrastructure.

Assistance such as lifeline service for the poor, or rate averaging support to high-cost areas, will and should continue into the next century. Some methods of holding down rates, however, will prove self-defeating if continued. Not only will such artificial rate suppression chill network development, but it will create other undesirable, or unintended results, such as prices that exceed substantially those a more farsighted policy would have fostered.

By deliberately underpricing services, competitive developments will be sacrificed. Local distribution competition today is much less evident than in other sectors of the telephone business. Additionally, research into new, possibly lower cost means of local distribution is lagging. A reason may be that competing against a deliberately subsidized service is obviously difficult. As competitive strength and research and development tend to be closely related, by suppressing competition, one tends inadvertently to diminish R&D that competitors need in order to succeed. Because R&D, in turn, tends to be one of the determinants of commercial success in export markets, yet another possible consequence is to diminish prospects for progress in international communications trade.

Deliberately suppressing or handicapping the provision of new services offered by established telephone companies has been seen by some as a means of ensuring provision of basic voice services at reasonable and affordable prices. The district court administering the AT&T consent decree, for example, determined in 1984 that permitting Bell companies to offer much more than basic local exchange services might somehow distract corporate managers from their assumed "primary mission." For well-meaning, if misguided, reasons the court also concluded that affording Bell companies the opportunity fully to compete in emerging "information services" markets might place competition at some risk.

These actions, however, had several unintended consequences. Foreclosing new service provision denied ordinary residential telephone subscribers the full opportunity to benefit directly from the latest fruits of technology. While a few firms attempted to provide new offerings to the ordinary subscriber, most chose understandably to focus on large business "profit center" customers. Additionally, new services which telephone companies might offer, and the revenue contribution they could make to fixed costs, were not promptly forthcoming.

Benefits from Competition

Policies that foster, not discourage, maximum use of the existing public network investment and associated human resources are also more likely to yield public benefits on a broad scale. If but a fraction of local service costs were defrayed by expanding telephone company service repertoires, it is probable that the price of basic telephone service would be lowered. An effect would be to expand customer options *and* further the national goal of universal basic service.

Restrictive policies may have been sustainable in a past environment dominated by a monopoly long-distance and local voice service provider in an era of stable technology. In the future, however, without the benefits of synergy associated with a growing array of information service offerings, efforts to maintain outmoded pricing structures and noncompetitive local service conditions stand to delay modernization of the country's telecommunications infrastructure, jeopardize the affordability of basic service, deny customers access to new and innovative services, and potentially compromise the competitiveness of U.S.-based firms as well.

Needed Actions

Action must be taken to remove these barriers. First, the local telephone exchange and cable television markets must be opened to competition. If Federal experience in the long-distance and telephone equipment markets is any guide, local communications service markets almost certainly need to become more competitive. Even for those markets, in which widespread competitive entry may not be economically feasible for some time, however, open entry policies should be considered nonetheless. In such cases, the threat of entry will encourage incumbent firms to control costs, lest inefficient operations accelerate the advent of competition.

As barriers to entry are removed, so too should those barriers which inhibit the ability of existing carriers to participate fully in an increasingly competitive marketplace. Local exchange companies, including the Bell operating companies with 80 percent of the small business and residential telephone subscribers, are in the best position to provide many information services to this broad base of subscribers. They have served this market for decades, brought to it highly sought after equipment and services, and know it well.

The Bell and other local exchange companies must be permitted to produce, store, disseminate, and process information, in addition to providing transport and switching. Allowing this "intelligence" to be incorporated into public networks should produce a growth in information services similar to that seen in the number of cable television program networks that resulted from major investments by the cable companies.

The Bell facilities now and as envisioned are a desirable means of accomplishing this rapid growth. There is no sound basis to assume, in addition, that there are significant competitive risks that could not be addressed through application of developing FCC "Open Network Architecture" and other regulations, and the general antitrust laws as well. The Bell companies themselves will sometimes be the most efficient supplier of some services. In other services, they will likely be outdistanced by competitors with a better product. Even with respect to basic services, there is reason to expect that, in the future, the Bell companies might be allowed to cross franchise boundaries and compete directly with each other.

Need for Open Networks

Another barrier is the current lack of "Open Network Architecture" (ONA) in local exchange facilities. ONA, when implemented, will facilitate equal and easy access to the public switched network for third-party information service providers. Among the stated goals of ONA are: (a) to increase competition in communications-based information services; (b) to provide the public with more efficient use of communications facilities; (c) to minimize any facilities-based competitive advantages the Bell companies may enjoy; and (d) to ensure that the public receives additional service options at competitive rates.

Development of an effective ONA framework so that the public network and information service providers can exist is critical. At both the Federal and state levels, regulators need to concentrate on encouraging the development of a public network through which both sets of service providers can bring new and valuable services to the public.

Competition and Universal Service

In the telecommunications industry over the past 20 years, less regulation and more competition, resulted in additional consumer choice, generally lower prices, usage stimulation, and increased investment, particularly in advanced technology. To some, however, the competitive telecommunications environment has been viewed as a potential threat to universal service.

To the contrary, competition has and will continue to act to expand universal service beyond basic voice service by encouraging both technological development and the introduction of advanced services. It is important, therefore, to remove barriers to entry, and to remove price and profit constraints on nonessential services and on other services for which effective competition exists.

Reform of Current Economic Regulation

For those essential basic offerings that are not yet competitive, steps should be taken to reform the current regulatory structure. Such reforms should be designed to reduce the prevailing disincentives to reduce costs and increase innovation which are associated with rate of return regulation, while also ensuring continued availability and affordability of basic telephone service.

The prevailing rate of return regulatory regime functions, in effect, as the "cost-plus" defense procurement system used to operate, with tremendous built-in incentives for inefficiency. Rate of return regulation has now been closely examined by nearly three-quarters of the states and significantly changed in many of them. While the FCC has proposed similar reforms, prospects at this time are uncertain given the existence of opposition. The longer we delay implementing such needed reforms, however, the more costly change will be. Delay also implicates substantial opportunity costs -- borne chiefly by ordinary ratepayers -- that government policy should seek to minimize.

As detailed in a comprehensive assessment of current rate of return regulation released by the NTIA in July 1987, as well as in subsequent analyses prepared by the FCC, it has become apparent that this traditional rate of return approach increasingly imposes costs which are disproportionate to any public policy gains. In lieu of encouraging cost reduction and efficiency, the prevailing regime tends to foster greater and less disciplined spending. The consequences ripple throughout other sectors as well. Because telephone companies too often have an incentive to purchase the most costly equipment possible, for example, in order to maximize their rate base, some equipment manufacturers tend to produce such equipment. As rate base regulation often discourages the deployment of the most innovative equipment, lest existing rate base investment be "stranded," it may well have the effect of discouraging the production of such products by American firms.

Our regulatory regime may make it possible for some equipment producers to sell relatively overpriced and less innovative output -- but that is precisely the kind of equipment that will not sell well in overseas markets. To the extent that U.S. operating companies have the incentive to purchase the most economically optimal equipment made, our equipment manufacturers will be better prepared for international markets.

In an era of increasing competition and rapid technological change, it is also important that depreciation schedules reflect the real economic life of plant and equipment. Depreciation should not be used to provide subsidies to current subscribers -- typically at the expense of future telephone users. Such practices distort investment incentives and may well deter investment in public networks subject to regulation.

Policies that encourage capital investment in new technologies in the long run will permit companies more efficiently to manage public networks, reduce costs, spread joint and common plant costs over more services, and thus provide increasing levels of both affordable and innovative universal service.

It is particularly important that we avoid policies which discourage the development of public networks at this juncture, given the trends which were identified earlier in this report. As non-public telecommunications investment and systems proliferate, the long-run viability of public services could arise as a significant issue. Most other developed nations place a premium on the need to maintain a public network, and often seek to do that by flatly prohibiting any competition in designated services. That sort of drastic solution does not appear to be needed. What is needed, however, are policies which strike a better balance. If existing deterrents are changed, there is no good reason to assume that public networks will not remain competitive and economically viable. That is important for those who most likely lack alternatives, such as smaller business users and most ordinary residential telephone subscribers. It is also important for other users, however, as it will tend to assure them the continued benefit of competitive choice.

Affordability of Service

Today, basic local voice telephone service is regarded as essential. Increasingly, regulators also are taking steps to target necessary assistance. Past policies usually entailed relatively indiscriminate subsidization. All local residential rates tended to be subsidized by assigning a disproportionate cost burden to toll and business offerings.

Appropriately, changes in these traditional practices have been made. Subsidies flowing to rural subscribers now are considerably more targeted. The FCC's institution of end-user access charges (and parallel initiatives in many states) also constitute sound reforms. Additionally, formal means have been established to assist individual subscribers. So-called "lifeline" rates, the FCC's recent "Linkup America" program (which offsets some telephone installation charges), and the FCC's "Universal Service Fund" place basic local telephone service within reach of almost all Americans. In aggregate, these targeted subsidies do not total more than a very small fraction of the overall regulated telephone service economy which, in 1988, should experience revenues exceeding $125 billion.

Many of the industry, government, and academic leaders at meetings with NTIA on this project noted that future policymakers may consider universal access to more than simple local voice telephone service to be an important goal. As access to new services becomes more important to the ability of individuals to function happily and productively in modern society, some predict pressures may build to devise subsidies designed to ensure access not only to basic telephone service, but also additional electronic offerings.

Our estimation, however, is that broadened subsidies may well prove unneeded, particularly if other, efficient policies are pursued. The fact that a given product or service is highly valued by the public, by itself, does not necessitate government-devised regulation or administered subsidies. Television service, for example, is highly valued by the public. Indeed, television set penetration is actually somewhat higher than is true of telephone service. Videocassette recorders also have become highly valued products and are spreading rapidly into U.S. homes. In neither instance, however, has government intervened to mandate special subsidy programs to guarantee public access. Instead, an economically unregulated market has succeeded in ensuring the universal availability of basic television service.

If established telephone companies were afforded means of expanding their service repertoire, as earlier discussed, it is reasonable to expect that the actual cost of basic telephone service -- as well as additional services -- will decline. This occurred, for example, when such new services as "call waiting" and "call forwarding" were offered. Not only could network costs be spread over revenues from more services, but regulators caused such services to be deliberately overpriced in order to subsidize basic rates. Relatively modest increases in current telephone company facilities usage would diminish unit costs. Policies that aim toward increased usage, more services, and less needless economic regulation, therefore, should be pursued.

The United States has a firm tradition of relying to the maximum extent possible on competitive enterprise to ensure the maximum availability of goods and services. With individual self-interest and the profit incentive as principal engines, our free enterprise economy has continued to deliver more to more people than any other system in the world.

Given that demonstrable record of unparalled success, policymakers should not assume from the outset that a less regulated, more competitive local telephone sector will not work. "Market failure," in short, should not be assumed. Should difficulties materialize -- and there is scant basis to believe that they will -- focused steps can then be taken to remedy any public interest shortfalls.

Conclusions

o Telecommunications policy has achieved universal basic voice telephone service. Efforts should continue to ensure that important accomplishment is not jeopardized.

o A vast array of new telecommunications and information services will become available by the year 2000, many of which will be used by most people in day-to-day life.

o Government-imposed legislative, regulatory, and judicial barriers continue to limit competition and innovation in local telephone service, cable television service, and Bell operating company information services.

o Regulators have begun to move from purely internal subsidies to more targeted subsidies, such as lifeline service, "Link Up America," and universal service funds.

o Present regulatory pricing policies delay modernization of the country's telecommunications infrastructure, jeopardize the affordability of basic service, deny customers access to new and innovative services, and potentially compromise the competitiveness of U.S.-based firms as well.

o Rate of return regulation is an outmoded "cost plus" scheme which has produced higher costs, fewer incentives for efficiencies, and less innovation than more modern regulatory approaches.

o In a fully competitive environment, new services could lead to the formation of an electronic "national neighborhood" or even "international neighborhood" which bridges geographic, economic, and social barriers.

Recommendations

- Policies should be adopted which will make it possible to achieve access to "universal information service" whereby ordinary small business and residential telephone subscribers have full access to the wealth of information and other innovative services upon which our success as an economy and society is coming to depend.

- More than this, we must focus on the creation of the world's best telecommunications and information infrastructure, which could lead to the availability of "video dial tone" and other innovative services.

- More reliance on competitive marketplace forces and incentives is needed, and barriers to competition, including in local exchange and cable services, should be removed.

- Rates for competitive services must be economically deregulated and rates for noncompetitive services moved toward cost, so that the marketplace will make the investments necessary to develop an advanced telecommunications and information infrastructure.

- Policies for assistance to low-income users should be focused, in order to target assistance directly to those who otherwise might be precluded. Market failure, moreover, should not be assumed in the case of additional communications offerings. If it materializes, which is unlikely, steps can then be taken to ensure access to new services deemed vital.

4

Ensuring Services for Rural America

Notwithstanding its great land mass and relatively low average population density, the United States today is among the most urbanized of developed countries. As earlier noted, some 100 million Americans live within 50 miles of our coasts. More than three-quarters reside in metropolitan areas. Some 90 percent live and work on only about five percent of our land. Rural America remains, however, a critical national economic, social, political, and philosophical component.

Two Scenarios for Rural America

In the year 2000, converging and emerging technologies could present rural America with a far greater degree of choice in the number and types of telecommunications and information services available. The geographic and economic constraints inherent in rural environments could be reduced as businesses and residences communicate in a far more effective and efficient manner. As the American economy and society in general become more dependent on information and information-based resources, the economic growth opportunities for rural communities could be significant. Our nation is shifting increasingly toward communications and transactions by electronic means rather than by paper, voice, and meetings. As a result, rural America could experience a rebirth of economic and cultural activity, and it should have an equal chance to become a part of the electronic "national neighborhood" described in Chapter Three.

Innovations in technology will make it possible for large corporations to relocate support functions such as check processing and credit operations to rural areas for favorable wage and tax rates, housing costs, utility costs, and general quality of life considerations. Businesses with large support service functions and billing operations (insurance, banking, credit reporting, etc.) may be drawn to rural areas in increasing numbers through advancements in computers, satellite technology, fiber optics, and other technologies that which decentralize business structure so that customers can be served more cheaply and efficiently from distant, relatively low-cost locations. Speedy and reliable data transmission, electronic mail, telemarketing, 800 services, and videoconferencing are some of the services provided by these technologies that could make it increasingly attractive to locate businesses (or parts of them) away from urban areas, bringing tax revenues and jobs into rural areas and spurring growth.

Citicorp, for example, has been among the most aggressive in capitalizing on some of the comparative advantages offered by rural areas. About half of its total office space is located away from its New York headquarters. The Sioux Falls, South Dakota location is responsible for credit card processing and reporting and provides a lower cost environment for a part of its business that requires no client contact or personal interaction with headquarters. Not only are costs lower, but the state of South Dakota provided financial incentives to relocate. This pattern has been repeated elsewhere and seems likely to continue as information resources grow in capability and ubiquity, and firms look to keep costs down.

Moreover, companies that begin and grow in small towns, such as Wal-Mart did in Bentonville, Arkansas, are now able to remain there. Wal-Mart installed a VSAT (very small aperture) satellite telecommunications system between its headquarters and all stores. Additionally, as more traditional manufacturing increasingly utilizes information technology, like computer-aided design and manufacturing, certain disadvantages due to remoteness are significantly reduced.

More generally, the fiber optic lines and microwave networks now criss-crossing the country are analogous to the railroads of the 19th Century and the interstate highways of the 20th Century. As we move toward the 21st Century, connecting spurs will undoubtedly be built by cities and towns eager to join the information age and by entrepreneurs who see the opportunity to serve smaller communities as installation costs fall. Again, Wal-Mart is a good example of the way that businesses in rural areas can capitalize on technology while benefiting from rural advantages and markets.

Two technologies in particular are already having an impact on the rural scene and should continue to do so in the future -- satellite communications and digital microwave radio. Because both use electromagnetic spectrum to carry voice, data, and video, they are relatively insensitive to the constraints of long distances and rugged terrain faced by providers of wired communication services. Not only will these and other technologies make provision of many services more economically efficient, but the nature of digital technology will allow a much wider range of services to be offered to individuals than would have otherwise been possible with traditional copper wires. For example, digital radio telephones presently being deployed on an experimental basis in rural sections of Wyoming not only provide residents with high quality voice services, but also data transmission capabilities in an area where conventional telephone service had never existed previously.

Distances and terrain also inhibit the ability of terrestrial broadcast radio and television signals to penetrate rural areas. Over two million homes, mostly located in rural areas, are already equipped with home satellite dishes, putting rural America on the leading edge of technology in terms of the dramatic enhancement of television signal quality and range of choice. The year 2000 holds the prospect of direct broadcast satellite (DBS) systems using high-power satellite transponders able to deliver digital audio sound and high-definition television signals to anyone within the footprint of the satellite.

Programming that addresses specific non-entertainment needs could also be delivered via satellite. The potential for these types of services, particularly in health and education, and their impact on rural communities in the year 2000 could be dramatic. Students in relatively isolated areas, for example, could enjoy the benefits of a fuller range of courses and be exposed to stimulating new ideas and teachers that would not have been available if physical presence had been required. Even today, for example, a company wishing to train engineers does not need to be located in proximity to a major university but rather can invest in a satellite dish to downlink and join the National Technological University (NTU). NTU is a satellite-based university which ranks among the world's best post graduate engineering universities.

Enhanced medical services and home health monitoring are already being delivered to rural areas over advanced telecommunications network systems. Such systems have proved not only more convenient, but have provided a higher level of care by allowing doctors to make what amounts to telephone-aided house calls. In the same way helicopters have been used to bring hospital care closer to rural areas, high-speed data lines can be used in a preventative manner by bringing outpatient care directly into the home or a small clinic.

This bright scenario may not, however, occur as described. There is a second scenario more reminiscent of the past, where some new technologies may only be economically feasible in relatively dense and populated areas. In other words, certain systems will be susceptible to the known investment constraints. If this is the case, rural America may not readily capture the full advantages of the new telecommunication technologies.

Under this less favorable scenario, the gap between urban areas, with increasingly modern telecommunications and information services, and rural areas, where deployment of these services may not be feasible based upon pure market forces, may grow. Rural areas will then be relatively less able to attract businesses and people, with negative results.

Challenges For Rural America

While rural America supports one of our largest and most important commercial sectors, agriculture, this component of our nation is not homogenous. Included within the designation "rural" are communities dependent on farming, mining, and forest products, some on manufacturing and service industries, others on the presence of military and public service installations, as well as relatively affluent retirement communities and areas which have prospered with the rise of America's recreational, tourism, and leisure industries.

Demographically, rural America remains older, less well-educated, and significantly less affluent, on average, than the United States as a whole. As in most nations, longstanding urbanization trends have meant a steady decline in rural population, which is ordinarily attributed to conditions that produce less than a full measure of economic and employment opportunities for young people. The rural areas immediately adjacent to major metropolitan areas are experiencing growth today, and forecasts are that these areas will be among the most rapidly growing for the balance of the century. In general, however, the demographic and economic characteristics of rural America are less conducive to growth, and these features also affect both the delivery and availability of a variety of commercial and public services.

Telecommunications Priorities

Compounding these challenges, the sheer size of the United States and the associated cost of providing both common carrier and other communications services have traditionally presented special regulatory and related issues. By virtue of the legislation enacted beginning in the late 1940s, which broadened the mandate of the Rural Electrification Administration to encompass telephone service, substantial direct Federal assistance and loan guarantees have been made available. A result has been to ensure a high level of telephone penetration in rural areas and, more recently, to assist in technologically upgrading services.

"Rural" in telephony does not always equate with "high cost." Costs ordinarily are significantly higher in rural areas, however, and the business and residential subscriber base across which they can be spread, is typically much smaller. These characteristics also have an impact on the level of advertiser-supported broadcast services, as well as the viability of contributor-sustained noncommercial offerings.

Regulatory and political assumptions regarding electronic mass media usually reflect personal experiences, at least in large part. As a majority of the American public is urban, so too are most communications policymakers. There is thus a tendency for many to extrapolate from the abundance of media choices routinely available in most urban areas, and to assume that rural residents enjoy a comparable video bounty.

Technological advances unquestionably have enriched the electronic news, information, and entertainment choices afforded rural Americans. Familiar developments, including home satellite receivers and video cassette recorders contribute to that choice. But these developments do not meet all the needs of rural Americans. Often there is substantially less local broadcast service, for example. Where a Chicago resident may receive literally dozens of AM and FM radio signals, a majority of which are generated by local stations, there remain large areas of the United States where local radio service, if it is available, is all too often offered only by low wattage, daytime-only stations. Local television service, moreover, is limited and a significant part of the rural population has access only to non-local service, either via satellite, cable television, or, more commonly, translator or relay ("booster") facilities.

Importance of These Services

As their choices typically are more limited, those communications services which are available to rural residents tend to be highly valued. Telephone service, for example, important to urban residents, may be critical to rural Americans as sheer distance may render alternatives infeasible.

In the case of electronic mass media, what local broadcast service exists also usually commands strong listener support. The loss of a single radio or television signal which might escape significant notice in Los Angeles, could represent a heavy blow for residents of a rural community. Procompetitive policies and assumptions regarding the likelihood of new entry -- which are generally warranted with respect to much of the country -- must be assessed as to their potentially irrelevant or unintentionally adverse effect when applied in certain cases in rural America.

Communications Policy Response

Regulation over the past decade has increasingly recognized the special communications needs and interests of rural America. Exceptions from general FCC rules, such as the prohibition of common ownership of collocated newspaper and television facilities, have been created for small rural markets in recognition of economic realities. Additionally, rural customers have benefited from urban-based competitive developments, as well as the demonstrated resourcefulness and ingenuity of rural telephone companies, broadcasters, cable operators, and others who have attempted to meet their needs.

Targeted Assistance

Traditional telephone industry cost accounting, coupled with practices such as inter- and intrastate toll service rate averaging, had the effect of channeling significant subsidy dollars toward building and maintaining the rural telephone infrastructure. As earlier mentioned, changes in traditional cost accounting practices as well as the breakup of the Bell System had potential to reduce rural telephone support. That potential has been blunted in significant part, however, by the FCC's actions establishing a "high-cost" support program. Through that program, administered by the National Exchange Carriers Association under FCC guidance, rural telephone companies with subscriber costs exceeding the national average by specified percentages are extended subsidies which amount to some $400 million annually. At the urging of NTIA and other parties, the FCC has also established eligibility standards and criteria which, in effect, tend to ensure that most rural telephone subsidies flow to small, independent companies, rather than the rural operations of major holding companies.

Additionally, maintaining nationwide interstate rate averaging has been established as a major FCC policy goal. Through this effort, price reductions attributable to competition on "thick" routes also inure to the benefit of rural subscribers who may not yet have the full benefits of competition.

Also at the urging of NTIA and other parties, the FCC has reduced Federal regulatory requirements previously placed on small rural telephone companies. At least two states with a substantial nonmetropolitan population and a significant number of small telephone companies (Iowa, where about 58 percent of residents are rural, and Nebraska, with 55 percent) have largely deregulated small firms.

Assisting Local Rural Broadcasting

Desirable changes have also had some effect in terms of assuring rural residents modest parity of broadcast and similar services. Changes in permissible operating hours for daytime-only AM stations, the establishment of a low-power television service, and a relaxing of previous restrictions on the operation of co-owned telephone and cable television systems in the same geographic area have helped. Recently, government also assisted in ensuring continued video service choices for home satellite receiver owners.

Communications Policy Challenge

Three fundamental communications policy challenges with respect to rural America will confront policymakers for the balance of the century. The first will be how best to ensure that the continuing transition to a more competitive environment, and desirable downward trends in prices for communications generally, do not adversely affect the choices available to rural Americans.

Second, policymakers should consider how to ensure that rural America benefits to the maximum extent possible from technological and competitive developments. This may entail, for instance, removing restrictions on the permissible activities of telephone companies serving less well-populated areas and, perhaps, doing so even faster than in more urbanized markets. Where the potential for competition could bring new technology, new services or lower prices for telecommunications customers, it should not be prevented by government action.

Third, steps will be needed to upgrade the level and diversity of communications choices in rural areas -- not only for business, but for residential customers as well. Meeting the communications needs of commerce and industry is obviously important, if rural areas are to grow economically. However, businesses will be assessing the communications services available and some will not be unaware of the services available to their workers, as well. They will thus tend to gravitate toward those areas where there is both an abundance of business *and* residential offerings.

Safeguarding Transitional Equities

All changes in complicated regulatory regimes have an effect on current stakeholders. Particularly when changes are driven or facilitated by Government policies, it is important that steps be taken to minimize potential harms, equitably distribute the costs of any transition, and assure that such costs are not improperly assigned.

If changes are instituted for the purpose of benefiting society as a whole, it is fundamentally bad public policy to visit all or a disproportionately large share of the associated transitional costs on any single group. In addition, those who stand to be affected by change must be accorded a full and fair opportunity to participate in developing the new rules. Such participation bears directly on the integrity of the capital formation and investment processes. For if those to whom Government looks to make the capital investments needed to deliver services cannot be assured of some degree of reasonableness and predictability, they may not undertake to make such investments -- or may do so only by demanding a higher return to offset additional risks. Reasonableness, predictability, and participation thus are important factors in any regulatory reform process.

To date, the FCC has sought to cushion any economic effects on rural communications interests through the instituting of special cost deferral and subsidization programs. These programs can and should be continued. Not only do they ensure the continued availability of essential communications services at reasonable prices, they also minimize the risks of ad hoc, interest-driven political intervention into the regulatory reform process.

Encouraging Provision of New Services

By more precisely tailoring Government policies to the realities of rural America, it may be possible to ensure that a meaningful measure of the benefits generated by technology and competition in communications and information markets is made available to rural residents.

Restrictions on the ability of telephone companies to provide information services, or operate collocated cable television systems, for example, tend to be geographically indiscriminate. The FCC has adopted rules that permit some phone companies in very remote rural areas to operate cable television systems in their franchise areas. Those exemptions from the general prohibition, however, do not obtain with respect to the rural operations of the Bell companies which, in any event, are further constrained by restrictions contained in the AT&T consent decree.

Rural Americans are as entitled to the benefits of actual and potential competition as urban dwellers. The first and overriding priority, however, should be service. Provision of new information services by the Bell company serving much of Wyoming, for example, should not be held hostage to a desire to ensure competition, when the realistic prospects of facilities-based competition in much of the state may be small. Both regulatory and judicial regulation, in short, should be targeted.

Special rules for rural areas should also be considered with respect to radio frequency management. Rules which may be appropriate in urban areas, again, are probably much less relevant in sparsely populated rural areas. This is particularly true considering that rural areas typically have substantially more unutilized radio spectrum available. As radio spectrum management becomes more sophisticated, through the use of systems such as the "Spectrum Use Measure" system which NTIA pioneered for Government assignment purposes, it becomes increasingly possible to adopt more flexible radio frequency management techniques. This flexibility could result in more channels for efficient, radio-based communications services in rural areas.

Similarly, the current trend toward reducing regulatory burdens on small rural communications companies should be continued, and indeed, accelerated. It is difficult enough to operate a very small, independent telephone system in a remote rural area without the Government imposing an array of regulatory requirements essentially designed for much larger entities. And while the elimination of virtually all regulation may pose some risks, they likely are far smaller in rural areas, where company and community tend to be even more closely tied than is true in larger population locales. At the same time, initiatives by rural telephone companies with respect to traffic aggregation should be facilitated.

Providing Technical Assistance

Federal training assistance today is afforded telecommunications managers and officials from developing countries, through initiatives such as U.S. Telecommunications Training Institute (USTTI), a business-government partnership. The Department of Agriculture's Rural Telephone Administration, as well as nonprofit trade associations, also provide some technical information and training assistance to small independent telephone companies, but the available programs are limited. Yet if independent telephone companies are to provide the services which their customers wish, and which could foster economic opportunities in less well-populated areas, expertise in new technologies and how to efficiently employ them is essential.

State, Federal, and industry talents should work together with the objective of developing a program that would make technical assistance and training available to small, independent telephone companies. If such help can be made available to developing countries, it can also be extended at home.

Organizations such as the National Telephone Cooperatives Association, the National Association of Rural Electric Cooperatives, the North American Telecommunications Association, and the U.S. Telephone Association should be encouraged to work together to develop programs which meet the needs of rural telephone operations. Additionally, the FCC should request the National Exchange Carriers Association promptly to report on the feasibility and desirability of providing limited financial support of such programs.

Stimulating Economic Development

As reports by the National Governors Association and other expert bodies show, telecommunications is becoming an important component of any overall economic development program. The telecommunications industry itself also represents a potential source of capital in this regard.

Abroad, telecommunications entities are playing an expanding role in overall community and economic development. U.S. policies, however, have tended to view established companies, most notably the Bell companies, differently. Their financial and human resources have been regarded more as a potential threat than affording opportunities for the nation. The emphasis has been put primarily on keeping hypothetical evils from materializing, not on encouraging good things to happen.

There are workable solutions to this difficulty. Broadbased waivers and exemptions from regulatory constraints could be made readily available if telephone companies undertake to further rural development. If a Bell company, or several companies together, undertake a rural development project, government should be prepared to encourage that effort.

In the final analysis, many of rural America's difficulties can be traced to the need for more people, more opportunities for young people, and economic growth. Of these, economic growth is unquestionably the key, as with it will follow a larger population base as well as expanded job opportunities.

Furthering the National Interest

Relying more on telecommunications and telecommunications policies to disperse U.S. economic activity and the population is desirable as a matter of national policy. The concentration of the U.S. population today, as earlier noted, is great and substantial pressures on the environment are an inevitable result. The ability of municipalities to provide the physical and social infrastructure to support such population density and associated concentration of economic activity already is being taxed.

In other countries, such as Japan and Mexico, government is actively seeking to encourage the dispersal of population and economic activity -- what might be described as "urban removal." The Tokyo-Nagoya-Osaka and Mexico City metropolitan regions are among the most densely populated areas in the world today, and government agencies in those countries have determined that current urbanization trends are simply no longer acceptable.

At a minimum, government policies over the next decade should seek to lessen existing incentives which drive such population and commercial concentration. Telecommunications policies which seek to ensure a greater parity of service options in rural areas will lessen one of the current incentives. Again, communications will not be *the* solution, but it will be an increasingly important component of any overall solution.

Conclusions

- By the year 2000, converging and emerging telecommunications, information and video technologies could present rural America with a far greater degree of choice in the number and types of services available and make it possible for rural America to be a part of the electronic "national neighborhood."
- New technologies such as digital radio telephones, television receive-only satellite dishes, very small aperture (VSAT) satellite systems, and more, are already in use in some parts of rural America.
- A less favorable scenario could occur if market forces are not allowed to or otherwise do not drive deployment of communications technologies at the same rate in rural as in urban areas, thus producing a widening gap in the communications and information services available.
- Congress, the FCC, and Executive branch have always recognized the

special needs of rural America and should continue to do so.

Recommendations

- Ensure that policies take fully into account the different circumstances prevailing in rural and urban America.

- Promote maximum competition generally, but assess each competitive policy as to its potential to be counterproductive in sparsely populated areas where the economic base may not be sufficient to support a single firm, much less competing firms.

- Continue existing support programs as needed and desirable, to ease the transition to a more competitive communications environment overall, without placing a disproportionate cost burden on rural residents.

- Pursue policies which encourage telephone companies, including the Bell companies, to offer new services in rural areas.

- Efforts to attract industry to rural areas should include consideration of enhancing the telecommunications and information facilities and services available through links with fiber optic or microwave networks, or teleports, for example.

- Encourage telecommunications companies and organizations to assist in economic development, and to provide training and technical assistance to small independent telephone companies.

5

Delivery of Education, Health Care, Governmental and Other Services Through Telecommunications

While pressures to reduce the size and growth of government should continue, it seems probable, paradoxically, that underlying demand for education, health care, employee training, and other public services will expand over the next decade. Some of this increased demand will be chiefly a function of population growth. The United States population may grow by 50 million people, according to some projections, and that alone will increase pressures on law enforcement, transportation management, and other sectors in which government has traditionally played a major role. Immigration is expected to be a major source of population growth, moreover, increasing demand for certain education and acculturation offerings, such as English-language training.

Other demographic factors will also alter the character of current demand. There will be proportionately more demand for adult and employee, as opposed to primary and secondary educational services, for instance, as birth rates are expected to remain relatively low while the work force will continue to experience changes which necessitate both further training of employees and retraining of displaced workers. In health care, an aging population should shift industry priorities from providing acute care services in hospitals toward preventative and long-term chronic health care delivered chiefly to the home.

All indications today are that demand for more or different governmental and related services will expand faster than the ability of state, local, and Federal agencies easily to provide them by relying on traditional methods and delivery modes. Just as commerce and industry have sought to leverage the efficiencies inherent in telecommunications and information technologies to enhance commercial effectiveness, governments likewise will need to increase their reliance on these "electronic tools."

Facilitating Deliver of Government Services

Government constitutes more than one-quarter of the U.S. Gross National Product today. Through their local, state, and Federal taxes, Americans support a diversity of government services, including law enforcement and fire safety, highway and air traffic management, public transportation, defense, emergency medical services, solid waste management, environmental protection, weather services, parks, and recreational facilities. These services, together with income support and individual welfare programs, constitute a major portion of overall American government, and the efficiency and effectiveness with which they are delivered has a direct and immediate bearing on the perceived quality of our national life.

Public Safety

Law enforcement, fire safety, and emergency medical services constitute among the most critical of government services. Public safety agencies are among the largest users of telecommunications today. Radio and other communications make it possible to deliver a higher level of service, as well as to maximize the efficient use of relatively scarce resources. Demand, in large part, is a function of population, and as the U.S. population grows, so too will requirements in this overall sector. Demand should also grow as a consequence of the complexities associated with a highly urban society.

Most law enforcement and public safety services today are the responsibility of state and local government. Federal involvement has grown over the past 20 years, however, chiefly with the emergence of new law enforcement challenges, such as drug traffic, which are national, indeed, international in scope and seemingly beyond the power of any single state or locality to deal with effectively. At the same time, the trend in law enforcement and public safety has been toward increasing coordination and cooperation among agencies. Additionally, some consolidation of certain emergency service dispatching functions -- the now-familiar "911" service, for example -- has occurred over the past 20 years.

Another manifest trend in public safety has been the rapid development of private security, alarm, and related enterprises. Usually working in cooperation with local law enforcement, security companies represent one of the fastest growing commercial sectors, and provide services obviously highly valued by their customers. These for-profit enterprises also make substantial use of telecommunications resources, and the demand which they represent is expected to continue to swell over the balance of the century.

Perhaps the single largest group of communications policy issues facing public safety and associated enterprises today relate to radio spectrum management. (See Appendix A for a general discussion of the spectrum management process.) Demand is substantially high and growing, in part because of large number of separate systems and, in some instances, incompatibility among systems.

Shortcomings have become apparent in emergency situations requiring the coordinated response of a number of differing agencies. When a major airline accident occurred in Washington, D.C., in 1982, for example, it was discovered that law enforcement, fire safety, and emergency medical services personnel from across the various jurisdictions in the Washington
Metropolitan Area had difficulty communicating with each other because radio equipment, channeling systems, and frequency assignments were not compatible.

Over the next decades, technological and commercial trends will offer some relief to difficult frequency management problems. NTIA, which has responsibility for Federal radio frequency management, for example, has adopted policies which now encourage deployment of "trunked" or common-user mobile radio systems by Federal agencies. Experiments are also underway which will entail greater reliance on commercial cellular mobile radio services. NTIA has also begun providing radio frequency management training to state and local communications officials.

Changes in this sector are complicated by a number of factors. Public safety and associated enterprises have a substantial investment in communications equipment and, at a time of budgetary pressure, understandably are reluctant to pursue options which might affect that embedded base. Common-user systems may not always satisfy critical response time requirements; in the case of certain public services, such as fire safety, even a small increase in average response times can entail very substantial increases in area insurance premiums, not to mention added risks to human life. In some jurisdictions, communications systems are also regarded as a key to maintaining institutional autonomy, and agencies tend to resist changes perceived as affecting their independence and status.

As pressures on radio spectrum resources grow, however, along with demand for public safety telecommunications, new policies will be needed. In general, greater reliance will likely be placed on commercial common-user alternatives, such as cellular mobile radio systems, to meet routine or administrative communications needs. Dedicated public safety communications systems should be increasingly reserved to meeting more critical requirements.

Additionally, greater emphasis will be placed on achieving a higher level of equipment compatibility and system interoperability. The FCC has taken steps to make frequency channeling plans more uniform; it has also encouraged use of digital tuners and other equipment that makes radio equipment more flexible. Similar initiatives are likely to be undertaken by NTIA with respect to Federal agencies.

As a long-term policy, the FCC and NTIA should also seek to accommodate public safety and associated requirements more by encouraging the use of sophisticated equipment and commercial common-user systems, and less by simply increasing the amount of radio spectrum allocated to these purposes.

In general, the more sophisticated the radio equipment, the more information can be transmitted using the same channel bandwidth. As the cost of such equipment continues to decline, it should be possible to encourage replacement of existing systems with new, more frequency-efficient systems. Safety-of-life communications requirements have always commanded radio frequency management priority. But this should be pursued in the first instance by encouraging use of better equipment, and only when that is infeasible, by reallocating radio spectrum.

Transportation Requirements

Air transportation management also places very large requirements on radio spectrum and other communications resources. Domestic passenger boardings currently are in the range of 450 million yearly. Today, there are some 12,000 takeoffs and landings on average daily. Congestion at some air transportation hubs and in some corridors obviously is already a problem.

The Federal Aviation Administration has underway major programs aimed at substantially improving its communications systems in order to accommodate projected traffic growth, and to ensure an even higher level of efficiency and safety. New communications systems, such as air navigation satellites, however, are being developed commercially and should also be explored.

Again, there should be a general policy of relying to the maximum extent possible on common-user communications systems and more sophisticated equipment. Such an approach will take priority over increasing spectrum allocations.

More Intensive Review

Today, each potential Federal and private sector user of the radio spectrum essentially decides, in light of its particular missions, policies, desires, and funds, whether, what, and how much radio communications is needed. It then applies to NTIA or the FCC for the requisite authorization. These decisions are not market based, but rather require NTIA and the FCC to make determinations that necessarily have substantial economic (particularly opportunity cost) implications. Too rarely are adequate cost-effectiveness analyses provided, whether in specific applications or in allocation proceedings generally.

The problem is easy to state; it is very difficult to solve. But it must be resolved if we are to have more effective frequency management and get the most benefit from the use of the spectrum. The collection and analysis of information basic to making an estimate of need is time-consuming and expensive; considerable skill may be required. Experience has taught us that it is difficult to look into the future with sufficient accuracy. Given answers to the questions posed, the task of analyzing the facts and making decisions on nearly one million applications a year obviously is enormous.

The problem here is one of money and manpower. There will be substantial pressure in this area to find ways to increasingly rely on market forces, which have the virtue of being economically efficient while low in transaction cost to government. Better ways to quantify and measure radio spectrum usage will be necessary for market mechanisms to be effective, however, and such improvements to our spectrum management capacity are not without cost. Additionally, it is expected that telecommunications and computer technologies themselves will provide ways in which these questions can be effectively resolved. The government alone has outstanding authorizations for more than 10 million transmitters. It is an enormous task to collect, assemble, introduce into the data base, and keep up to date the quantity of technical data needed. Yet, the strength of computer and telecommunications technology rests in the ability to capture information more easily, accurately, and cost effectively, and similarly to allow such information to be flexibly manipulated and displayed in a timely and useful form. To carry out this task will place some additional burdens on both industry and government. Nevertheless, it has to be done if we are to get maximum use of this resource and accommodate all the demands likely to be forthcoming. More than just a start has been made in this direction by NTIA, particularly through its new Spectrum Use Measure (SUM) approach, which joins the technical properties of the radio spectrum to the geographical dimension in a manner that allows for the quantification, measurement, and graphic display of how the Nation's spectrum resource is utilized. Over the next decade, however, additional effort by both NTIA and Federal user agencies will be needed.

Meeting Education and Training Requirements

Education constitutes one of the nation's largest and most important activities. About one in every three Americans is enrolled in some kind of education program during any given year. In addition to our formal system of education, from kindergarten through college, adult education has increased dramatically over the past decade. Employee retraining is also becoming more essential to our efforts to deal with a changing economy and workforce.

Many of the characteristics basic to America's educational system have not changed significantly in a century. Education has remained primarily a labor intensive, paper-based process. Meanwhile, our society and economy are rapidly moving into the information age. How effectively this nation's educational system makes use of telecommunications and information resources will in large part determine how successfully we can compete in the world economy, and continue to meet other national needs.

Leveraging Scarce Educational Resources

In some senses, the challenge facing American education is no different from that in other sectors: How best to get maximum results from scarce resources.

As in other professions, the level of talent, proficiency, and experience varies among teachers. The distribution of that talent among academic institutions also varies; some school districts, colleges, and universities have a disproportionately higher caliber teaching cadre than others. All have teachers and professors skilled in different areas (e.g., mathematics, science, and foreign languages).

Given time and resource constraints, means must be found to help achieve a more equitable distribution of teaching talents and thus educational opportunities. Also needed are means of ensuring that educational professionals are able to maintain high levels of training and competence, notwithstanding the financial limits which have affected traditional teacher training, sabbatical, and related programs.

Telecommunications technology offers a promising means of accomplishing these desired goals. For example, increasingly more powerful electronic tools placed in the hands of teachers and students, plus increased interactive capability, could alter the physical characteristics that most people presently associate with formal education. Individuals may be able to design their own electronically-delivered learning curriculum, based on a perceived need for training. A teacher could tailor coursework for a slower student, supplementing the regular class instruction with a combination of telecommunications-based, interactive tutorials. These could take the form of training courses stored on a disk, digitally stored in a library or school for easy access and, transmitted to the student's home television receiver or data terminal.

Artificial intelligence will help identify stumbling blocks for individual students. Simpler forms of software will help subjects where repetition or practice is a key, such as in chemistry or language and vocabulary training. Computer simulations that make use of images, sound, and text will help remove barriers.

Adults will likely be able to acquire new skills or brush up on existing skills in a short period without disrupting normal work schedules. Combinations of interactive classes offered by a local or distant college could provide training in the privacy of a person's home. An employer could have a number of employees participate in classes through an on-site, interactive training center capable of linking a number of private and public institutions. This is beginning to happen now through the National Technological University (NTU).

Joint research and development programs linking major universities via communications networks, and sharing access to information and data bases stored on supercomputers, already provide volumes of information at the fingertips of researchers. The continued linking of these networks and data bases will potentially reduce significantly the research and development time presently associated with major academic achievements. Such links could also increasingly speed the actual product development time of newly discovered techniques, services, and technologies.

Nationwide, satellite-based communications systems have already been established. A number of major urban school districts, some parochial school systems, and the country's largest single educational enterprise, the U.S. Defense Department, already have formed one consortium that distributes instructional programming and focuses especially on teacher training. Several dozen universities' faculties participate in another national satellite-based network which specializes in providing on-site, post-graduate engineering and management training. In more than 20 states, educational and public broadcasting leaders are working to develop mutually usable programs aimed at enriching education.

Past educational television efforts suffered from the poor quality of programming or "software," as well as the lack of efficient distribution means. The increasing involvement of noncommercial, public broadcasters, however, offers substantial potential for improvement.

Public broadcasting has demonstrated an increasing ability to package information and instructional materials effectively, and in a manner conducive to maximum consumption. This trend is expected to continue as a majority of public broadcasting organizations are affiliated with educational institutions. Greater efforts are being made to harness the program production talents and substantive expertise of these parallel enterprises to produce the best possible results.

Telecommunications and the educational services it facilitates will never substitute generally for the traditional teacher-pupil relationship. These technologies, however, have great potential value to supplement and enhance teacher-pupil interaction. Properly developed, such communications systems could make it possible for all students to enjoy expanded educational opportunities. This is important to ensure that our citizens will be equipped to participate fully and productively within American and global society.

Expanding Individual Choices

Telecommunications and information technologies also afford individuals expanded choices in educational, instructional, and job-related training. Videocassettes providing information on an extraordinary range of instructional, self-help, and related topics already are produced and increasingly are marketed widely. Further advances in electronics, moreover, are expected to alter program production, distribution, and information storage and retrieval costs. The result should be more choice among higher quality alternatives.

In less than a decade, individuals should be able to dial up a diversity of electronically-stored information and review that information at a time of their own choosing. This will provide an opportunity to obtain additional education and training needed to retain a job, advance, or secure new employment, and to do so more easily. Today, individuals generally structure their lives around pre-arranged instructional schedules; technology, however, should help ameliorate this and make it possible for instruction to be better fitted to individual time schedules.

Expanded access to educational and instructional information on a demand basis should benefit parents seeking additional assistance for a lagging child. It should also provide gifted and talented children with additional opportunities to learn more than what is offered as part of a general educational program. Additionally, such expanded access should benefit teaching professionals, by making it easier for them to maintain or improve their competency in a given field.

Need for Greater Emphasis

A high level of educational attainment is important to maintaining the strength of the U.S. economy. All too often today, industry is required, in effect, to pay twice: that is, through taxes supporting the public education system, and then with additional expenditures on entry-level workers not able to perform at minimum competency levels. By making it possible to raise the common denominator of public education, telecommunications and information technologies and their creative applications, have the potential to reduce this economic waste.

A well-educated populace, moreover, has traditionally served as a cornerstone of our democratic political system. There is a direct correlation between levels of educational attainment and later income, as well as individuals' willingness to participate actively in the overall political process at the local, state, and national levels.

In line with the priority accorded economic imperatives and national competitiveness today, and the general sense that educational attainment and our economic future in a global economy are inextricably intertwined, we should experience renewed focus on fundamental educational goals and missions. We should seek to sharpen that focus, and seek to ensure a more equitable distribution of teaching resources and educational opportunities through greater reliance on telecommunications' new technologies.

Development of an enhanced telecommunications and information infrastructure could foster the advent of new educational services and new technology-based teaching aids. These services and aids could present an unparalleled opportunity to provide more Americans, including minorities, the economically disadvantaged, the physically challenged, and recent immigrants, with the opportunities that American education and culture can yield. The integration into society of an increasing number of foreign immigrants could be made easier with educational programs such as language classes geared specifically to their needs and made available at convenient times. A well-developed telecommunications and information infrastructure has the potential to deliver these new services at prices that could be reasonable and affordable for all.

Making full use of the potential of emerging communications and information technology may require major investments in research, as well as government policies that promote the development of these technologies by the competitive private sector. Educational service providers and users need to stimulate the development of technology specifically oriented to their needs. The importance of communications and information resources, in summary, cannot be understated in the area of education, for this will in major regards determine the ability of the U.S. economic system and culture to adjust and respond to global changes in all sectors.

Universal Information Education

The proliferation of productivity-enhancing telecommunications and information technology, and the greater role these applications will play in our national economic and social life, should entail providing "universal information education" to those not now receiving it on the job or in school. "Universal information education" means that, in addition to reading, writing, and arithmetic, an

American citizen in the year 2000 will need to know how to access, locate, process, and transmit electronic information, whether at the plant, in the office, to pay bills or find material at a library, or for use in-home to access information services and data bases.

Many of our students, particularly in suburban areas, now receive this training, and much of our labor force receives on-the-job training. Important groups are missed, however, including students whose schools do not provide computer training, employees whose jobs do not yet require it, and those for whom formal education has ended. Our overall educational system, in short, must have the ability to teach students and others to use the tools of an information age.

Meeting Tomorrow's Health Needs

Health policy in the United States has traditionally sought to expand access to care through the development of insurance and other third-party payment mechanisms. It has also focused heavily on providing acute care, typically in a hospital or other medical institution. Less attention has been accorded preventative care, or meeting long-term, chronic health care requirements, particularly in the home.

Over the next decades, major challenges will confront the U.S. health care industry. Americans have made it clear they want access to quality health care, but at reasonable cost. Yet the costs of health care continue to skyrocket, increasing since 1981 at an average nearly twice the rate of inflation. Health care expenditures have nearly doubled as a percentage of Gross National Product (GNP) since 1965, and now constitute about 10.7 percent of GNP. Between 1975 and 1985, Federal spending on Medicare and Medicaid alone more than quadrupled, rising from $25 billion to about $103 billion a year.

At the same time public concern regarding the cost of traditional health care systems is increasing, new demands are arising, chiefly as a function of our aging society, but for other reasons as well. Health care experts maintain that more emphasis on preventative services, pre- and postnatal care, for example, can help ameliorate, perhaps reduce acute care expenditures. We will also need to examine alternatives to institutionalizing older Americans in increasingly costly and depersonalizing nursing homes and similar facilities.

In addition, problems regarding the distribution of health care services persist. Too many remote rural communities and urban ghettos, for example, lack a level of health care access and service comparable to that routinely available in affluent suburban areas.

Part of the Solution

Telecommunications and information technologies are not the panacea to all of these emerging medical care challenges, but they are a promising component of any comprehensive solution. The application of communications and information resources to the health field will continue to transform both the manner in which individuals receive health information and the amount, quality, and timeliness of that information. The consumer should be able to access data bases on health, from preventive care to first diagnosis and treatment for specific maladies.

These new applications, from the sharing of resources between hospitals to telemetry applications for monitoring patient recovery in the home, have the potential to dramatically change health care in this country. The Mayo Clinic already uses "telemedicine," for example, to link the clinic with specialists around the country via two-way broadband television. "Telemedicine" applications could be greatly expanded in the 21st Century. Telecommunications technology could also spur the formation of regional centers concentrating on treatment for special health care problems. With the ability to conduct a videoconference with data exchange between two or more locations, doctors and patients will be able to obtain almost instant consultation and second opinions. Surgeons would participate in surgery via high-resolution video links. Hospitals could access the expertise of leading specialists, minimizing demands on those individuals while sharing the expense with other hospitals countrywide.

Applications of communications and information resources to medical and biotechnology research and development efforts already provide the benefits of shared resources and speedy access to information, in addition to near-instantaneous coordination with research efforts at other research and development centers. As with other R&D networks, enhanced health research networks could enable the medical profession to reduce the time lag inherent in bringing new health products and techniques to market. International cooperation can also be enhanced, thereby speeding the development of cures for life-threatening diseases. Such computer-communications networks already are employed by public health agencies worldwide, and reportedly have benefited cancer, AIDS and other medical research priorities.

Some communications systems already are employed to provide long-term care in the home. The chronically ill and the handicapped can now employ telephone-linked monitoring systems as a supplement to in-home care provided by health care paraprofessionals. These applications are not substitutes for traditional medical care. But particularly for an increasing number of elderly Americans, they provide sufficient assistance so that resort to institutionalization can be delayed, shortened, avoided.

Meeting Tomorrow's Employment Challenges

New technology is fueling economic growth, especially in industries such as electronics, communications, engineering, biogenetics, chemical specialties, pharmaceuticals, aerospace, and advanced ceramics. The pace of new technology development is compressing product and process life cycles in these and many other industries. Any set of worker skills, therefore, may become obsolete in five to ten years. Life-long continuous workforce education will thus become an important national priority. The fastest growing job categories are also expected to be in professional, technical, and sales fields requiring the highest education and skill levels.

Telecommunications and information industry developments over the next decade should make it easier for the business community to fulfill new employee needs. A number of major firms, for example, already have devised procedures to permit employees to work at home, connected to the work place through telecommunications. So-called "telecommuting" is an increasingly commonplace phenomenon. This makes it possible for working women to both participate in the work place outside the home and, at the same time, satisfy traditional childraising needs. A result is to further economic and productivity objectives while, at the same time, strengthen the family as society's basic institution.

Government Responsibilities

America's work force has always provided one of its key competitive edges. The American worker remains on average one of the most productive and hardest working in the world. The next generation of Americans, however, will have their own set of goals and expectations, and some will likely be much different from those of today. They will likely expect greater benefits, higher pay, more flexible work hours, a greater voice in decisionmaking, and more personal job fulfillment.

Communications and information policymakers will need to work to ensure that an infrastructure is in place which will satisfy these new goals and priorities. A communications infrastructure which is ubiquitous and amenable to data and video applications, for instance, will facilitate work at home. Additionally, a communications system which will facilitate access to information services could also facilitate the overall process of accommodating new employment priorities. A result of changes in prevailing regulatory and judicial restrictions on the widespread availability of information services provided by telephone companies, for example, could be to make the transition to a more flexible, "people oriented" workplace easier.

Telecommunications and information service developments, in short, have more than simply an economic or commercial quotient. They offer the promise of significant improvements both in the work environment as well as in the overall quality of family and social life.

Effect on Volunteerism

One of the most interesting implications of communications and information technology is its potential effect on volunteerism. It is often commented that one of the distinctive aspects of American life is how strongly oriented we are toward voluntary private activities, from charitable work to involvement in a hobby.

Since de Toqueville's time, this element of the American character, coupled with our tradition of free and active association, has yielded a vibrant harvest of culture and subculture. The benefits generated by computer and communications technology, while often initially developed for the large user, will inevitably find their way into the homes and meeting places of America. There, these benefits already are creatively applied to everything from volunteer work that addresses the basic needs of the less fortunate, to innumerable less serious efforts undertaken in the pursuit of happiness.

Communications, information, and computer technologies, with their potential to capture, organize, and instantly transport all types of information in readily usable form, will offer new opportunities for Americans to tap this spirit of volunteerism and creativity. Those with skills in basic or specialized areas will be more easily able to contribute their knowledge to others. Additionally, because of such things as the ability to "time-shift," they will be able to volunteer their efforts more efficiently and conveniently. This type of high-technology volunteer activity is already occurring on "computer bulletin boards" which can be dialed up using the telephone network. It may also offer new avenues for people to turn their hobbies into a career.

Again, a distinctive feature of these technologies is their ability to render distances less relevant and to unlock resources which have traditionally been bound to a specific location. While the extent of the effect of the information age on volunteer activity is only just beginning to be appreciated, it is clear that there exists substantial potential for improving our quality of life.

Other Government Services

Government today comprises more than a quarter of our economy. Because excessive or avoidable administrative costs diminish the resources which would otherwise be available to satisfy program objectives, the efficiency with which state, local, and Federal agencies operate has a direct bearing on the level of services which can be delivered to the public.

Communications and information resources can make the same contribution toward efficiency in the delivery of government services that they can in the delivery of business and commercial services. Most government agencies, accordingly, already have begun to take steps to harness these resources to improve the effectiveness of their operations. The Departments of the Treasury and Health and Human Services, for instance, currently are among the largest users of communications and information services in the world. Additionally, the General Services Administration has developed plans for a comprehensive upgrading of the Federal Telecommunications System, denominated "FTS 2000," which seeks to provide a sophisticated, common-user telecommunications and information network that will satisfy the evolving requirements of Federal agencies.

At the state level, telecommunications services are also gaining higher visibility and priority. New York, Iowa, Washington, Florida, and other state governments have programs underway which aim at substantially upgrading state telecommunications networks.

The breakup of the Bell System significantly affected the way in which Federal, state, and local governments buy communications. It increased choice, flexibility, and price competition. However, it also complicated the task of ordering and managing telecommunications. In several instances, government agencies expanded their own communications and information management staffs, as did communications buyers in the private sector. In the four years following the breakup, moreover, a number of government agencies established their own facilities-based communications systems, as did many major private sector communications users.

Existing fundamental policies require government to rely to the maximum extent possible on the private sector meeting communications needs. Much of the trend toward major users vertically integrating to meet their own communications requirements through the deployment of dedicated facilities may in some cases be more a function of prevailing tariff imbalances than genuine efficiencies. Rationalizing the current common carrier pricing system and, in so doing, moving prices closer to underlying costs, has been a major Federal (as well as state) communications policy priority. Where there are genuine efficiency gains, or special mission requirements, agency deployment of dedicated communications systems may be warranted. But if such facilities are purchased and deployed, and subsequent regulatory reform results in bringing carrier prices more in line with underlying costs, the result might be to strand that public investment, or saddle taxpayers with unnecessary communications costs. Government's overriding priority, therefore, should be to foster competition and regulatory reform.

Security, Safety, Convenience, and Entertainment

Developments affecting the household could provide the greatest evidence of the impact of telecommunications and information resources in our daily lives. Americans will be spending more time, both business and leisure, in their homes. Such factors as the increase in the number of two-income families could lead to the rapid acceptance of electronic-based technology for a number of everyday tasks. A pervasive difference in American life will be the increased demand for time-saving devices. Families will place a higher value on limited leisure time, and seek convenient methods to eliminate everyday chores with the stroke of an ENTER key, the turn of a dial, or by punching a few tones on a telephone handset.

This demand for time-saving services, along with safety and security, education, health and entertainment needs, will speed the emergence of the electronic household or "smart house". Services will be available through computer terminals, "smart" phones, or television receivers, as well as the regular telephone. In some cases, all may be combined into one piece of equipment or an integrated home system created with components.

Currently, the greatest proportion of home-related telecommunications and information resources are expected to be used for entertainment purposes. The television, radio, and telephone will remain the major means of bringing information into the home at the beginning of the 21st Century. But, advances in technology and information delivery systems will provide the greatly increased bandwidth capacity needed to provide service for increasingly information-intensive, home-based activities.

Applications of advanced technology include a "video dial tone" for accessing video programming on demand from any place in the country, or even for transmitting video as well. Monitoring systems could also be used to watch children, elderly or handicapped individuals, ensuring their health and safety. The appliances in a home could be controlled through computer software either on the premise or from remote locations, offering added convenience, time-saving alternatives, and energy-saving efficiencies.

Consumers could also enjoy the added advantage of tailoring to their individual preferences the information they read on a daily basis. This should include electronic newspapers or other forms of electronic publishing. Many of these are, to a limited degree, already available.

Conclusions

- The telecommunications and information infrastructure is increasingly an essential, integral part of business and societal life, and no longer merely a helpful support function.
- A well-developed telecommunications and information infrastructure could provide crucial, pervasive, day-in, day-out benefits in the personal and working lives of all citizens: it can improve the education system, facilitate health care, provide small business opportunities, provide for safety and security, strengthen the family, and encourage broader participation in the life of the community.
- An advanced infrastructure will enable vendors to create the services and specific applications of services to the various sectors that will allow for U.S. industry to gain a competitive edge through improved productivity, improved quality, and faster innovation in the work place.
- Users as well as providers have participated in the development of the U.S. telecommunications and information infrastructure, particularly the education community. Such involvement has already produced increasing public investment in the infrastructure. The Public Television Facilities Program of NTIA has helped fund, for example, the satellite-based National Technological University (NTU) and similar initiatives. State universities have funded microwave and satellite educational networks. The Federal government itself owns and operates extensive networks used by its agencies and for delivery of agency services. Hospitals, schools, and libraries throughout America have created new portions of the infrastructure as well.

Recommendations

- Just as the "open skies" policy of the 1970s increased satellite telecommunications competition, improving quality and reducing costs, and thereby enhancing the electronic fabric of our economic and social life, similar "open entry" for local alternative network providers, cable television service, direct broadcast satellite, teleports, multichannel multipoint distribution systems, and technologies not yet known will enhance the development of a vastly improved infrastructure.

- The role of regulation should be de-emphasized and instead the focus should be on the critical need for enhancement of the telecommunication and information infrastructure.

- Leaders in our educational, health care, employment training, security, and other industries must assess and reassess their efforts to deliver faster, higher quality, and less expensive services over the telecommunications and information infrastructure, and continually consider how to coordinate their planning with providers in order to facilitate infrastructure improvement at the optimum rate.

6

Maintaining America's Strength in Markets for Telecommunications and Information Services

America's economic, political, and cultural strength in the year 2000 will be significantly affected by the vitality and robustness of its telecommunications and information sectors. Before the turn of the century, nations which emphasize the development, production, processing, storage, retrieval, transmission, and management of information will likely command a substantial comparative economic advantage. The United States cannot afford to be less than the best in this regard.

A nation's communications and information resources can be expected to play as pivotal an economic role as transportation and natural resources did in years past. Today, most foreign industrialized nations are heavily involved in promoting the capabilities and prospects of their indigenous telecommunications and information industries. While this should not cause the United States to draw back from its traditional reliance on open and competitive markets to achieve economic success, it will require sustained and considered effort toward ensuring that foreign governments do not regulate their home telecommunications markets in ways that create market barriers harmful to America's national interests.

The international telecommunications environment is undergoing increasing volatility and change. Forces which drove change in the United States are also present overseas. The changes which the United States has made, moreover, have caused other countries to reappraise their policies in this general area. Traditionally, telecommunications in most countries has been controlled by a single entity -- a postal, telephone, and telegraph ("PTT") administration -- which has functioned as a government-owned and operated monopoly. As earlier noted, however, several nations including Japan, Canada, and West Germany, have commenced liberalization programs. In virtually every instance, change has been grounded on arguments that advances are needed to maintain technological parity, strengthen the domestic economy, and safeguard national scientific and engineering independence.

Today, almost for the first time in its history, the United States faces strong challenges to its technical and commercial telecommunications leadership. Trade statistics show the country going from a recent significant trade surplus in telephone equipment, for example, to a deficit that it is estimated will exceed $2.7 billion for 1988. In the broader category of electronics-based products, the United States had a trade surplus exceeding $7.3 billion in 1980, yet by 1986 this had become a deficit of almost $16 billion.

A number of factors have contributed to growing deficits in telecommunications markets. Experts disagree regarding both precise causation as well as the most promising cures. The passage of recent trade legislation, which included a specific telecommunications section, demonstrates, however, that this has become a high national priority.

Overall, it is in this area of international telecommunications trade-related issues where our efforts and those at the Telecom 2000 meetings have identified the greatest concern and the most significant negative trends facing American communications for the remainder of this century.

The trends and their implications for America are substantial. As a consequence, over the next few years, more extensive Government involvement in international telecommunications and information issues is a certainty. Greater awareness of the effects of domestic communications regulatory and other actions on this key sector also is likely. We expect policymakers to become increasingly aware of how decisions on communications infrastructure development, standards development, research and development, and spectrum resource allocation can have a direct and substantial impact on our international trade balance in telecommunications equipment and services. As a result, we expect this area will be subject to increased public and political scrutiny.

In our discussions with industry, academic, regulatory, and other experts, many comments were made in favor of less Government involvement in domestic telecommunications and information markets. At the same time, many comments favored substantially greater U.S. government participation in international communications arenas. These include international radio spectrum regulation, associated multilateral discussions regarding satellite orbital use, standards development, communications trade policy, and foreign market access. This difference appears based on the increasingly active involvement of foreign governments in these areas. Experts expressed the view that foreign governments, as is true of the U.S. Government, have come to recognize the broader economic importance of these seemingly technical areas and thus have intervened on behalf of their perceived national interests.

Over time, there may emerge internationally a consensus in favor of less government involvement by many nations, not more. As other major countries liberalize, the need for any continuing, major commitment of resources by the U.S. government to foster more open and competitive market conditions may diminish. Except for issues affecting telecommunications trade, long-run international communications related trends seem essentially positive. In the short term, however, more extensive, coordinated actions by the U.S. Government will be required.

Tensions in the International Marketplace

The international telecommunications and information marketplace today reflects the tensions which predictably arise when parties pursue different and, in some ways conflicting goals. On the one hand, it reflects a substantial impact on policies driven by a blend of technological, economic, and multinational competitive forces. On the other hand, this marketplace also reflects persistent efforts on the part of some governments to manipulate the terms of competition to their benefit. Increasingly, global interdependence is juxtaposed with national industrial policies which still seek to forestall foreign access to domestic markets and yet target foreign markets for subsidized entry. The effect on America's ability to compete has already been substantial. There is a growing awareness of the long-run costs which foreign protectionism can impose and an increasing demand for government action in response. In some sectors, business has actively solicited U.S. government protection and other special assistance.

Assessing the Balance

There is disagreement whether technological innovation, multinational business competition, and consumer demand -- or government intervention and industrial planning -- will over time prevail. If global market forces predominate, however, and we believe this will be the case in the long run, there should emerge a more competitive world marketplace in communication equipment and information goods and services, characterized by innovation, lower costs, and the ability of nations to exploit comparative advantages. In such an environment economies of scale and scope could create additional pressure for accelerated merger activity, joint ventures, and strategic alliances. Overall, the nations that liberalize their regulations and allow facility- and service-based competition will achieve substantial consumer and marketplace benefits.

Facility or service overcapacity would likely provide vigorous price competition, and perhaps, increasing pressure to eliminate unprofitable equipment and service offerings. This could cause some governments to intervene and invoke fear of service abandonment, unemployment, foreign domination or trade deficits. While nations may want to restrict or foreclose market access, ostensibly to safeguard their industries, such actions deprive their citizens and businesses of efficiencies and the new technologies needed to compete in other global industries, and are self-defeating in the long run.

Holistic Approach Needed

As we near the year 2000, we will require international telecommunications policies that reflect domestic experiences and vice versa. Increasingly, we have grown to realize that the international telecommunications and information marketplace requires special government attention. To ignore such requirements risks relinquishing market share, notwithstanding our competitive strength and policy leadership. We can no longer afford to act impulsively and unilaterally to improve market access to this country, such as occurred in connection with the breakup of AT&T. Adequate consideration to the implications of trade and industrial competition must be given to implications and trying to obtain comparable market opening in return.

America's role in global communications and information matters will increasingly necessitate development of bilateral and multilateral perspectives, and recognizing the need for preparation and robust advocacy. We must attempt to mesh our national policies with other acceptable prevailing global policies. While redoubling our efforts worldwide to promote competition, consumer sovereignty, and market-based resource allocation, the United States must nonetheless recognize and account for different policies followed in much of the world.

We cannot and should not unilaterally impose our vision upon the world, even if it derives from basic values or successful domestic results. Nonetheless, with vigorous advocacy, we have seen nations accept U.S. policy initiatives, for example, regarding the benefits of competition from international satellite systems separate from INTELSAT, and other similar approaches which already have enhanced consumer welfare in the United States. We expect more countries to rely on competition and open markets, ultimately because such procompetitive policies are in their interests as well as our own, and because failure to such approaches, with respect to communications particularly, will be costly.

A Lesson From Our Domestic Experience

Results of the AT&T divestiture demonstrate how domestic policymaking can have serious unanticipated international implications.

Loss of Market Opening Leverage

A result of the Bell System breakup was an improved opportunity for foreign access to U.S. communications equipment markets without regard to the comparable access to foreign markets. It was a unilateral action that produced domestic market gains. It resulted, for example, in significant reductions in telephone network equipment prices; although these prices were already declining as a consequence of technological changes, increased competition from abroad appears to have pushed those reductions faster. Competition also stimulated U.S.-based firms to be more productive and efficient. The rate at which changes were incorporated into our domestic telecommunications network increased.

At the same time, leverage which the United States might have used to open communications markets abroad was relinquished. The United States thus faced the unfortunate situation where its leading suppliers lost domestic market share, but were unable to expand their sales overseas, and the ability of the government to secure such market openings became more limited.

The Future Role of Government

Other chapters in this report discuss the desirability of decreasing Government involvement in many communications and information marketplace decisions. Government, however, remains a major factor in international communications today. Some nations have recently adopted policies based on principles of private ownership, significant competition, and customer sovereignty. As a result of liberalization and privatization policies, British Telecom is now predominantly private, for example, and in Japan, Nippon Telegraph & Telephone, has begun privatization this year. Canada has privatized its international carrier, Teleglobe Canada. In each market, communications competition has materialized.

A majority of national communications markets, however, has not yet been significantly liberalized. That is reflected in policies pursued in international communications forums, as well as in multilateral treaty organizations such as the International Telecommunication Union (ITU). A policy of U.S. Government non-involvement, accordingly, does not mean international communications decisions will be reached by a private, competitive marketplace. Indeed, in some instances the practical effect may be to relinquish U.S. ability to make or affect determinations to foreign-based monopoly interests. Rather than promoting competition, in short, precisely the opposite can be the result.

Continued U.S. Government Participation Required

Other governments open or keep closed their telecommunications markets for a number of different reasons. Predicting, therefore, how quickly specific foreign markets for telecommunications equipment and services will open on a widespread basis is difficult.

The pace of progress should not deter continued U.S. procompetitive initiatives. NTIA and other agencies within the Federal government, such as other Department of Commerce agencies, the Office of the U.S. Trade Representative (USTR) and others, must continue to work with foreign administrations to achieve more legally and effectively open communications and information markets. An ongoing presence in foreign locales, such as that provided by the U.S. and Foreign Commercial Service, bolstered by continued support at home, can provide U.S. industry with the information, advocacy, and assistance needed to access and address market opportunities.

Government should continue to ensure the resources necessary to support our international communications and information policies are available. A key feature of policymaking between now and the year 2000 will be adaptability, and the willingness, if necessary, to actively promote and secure mutually advantageous communications market access.

The International Telecommunications Infrastructure

The telecommunications infrastructure of each nation serves as a fundamental building block upon which worldwide networks are built. Global markets require fast, efficient, and ubiquitous telecommunication conduits. Financial and stock transactions are now conducted 24 hours a day through networks that link the world's major financial centers. Such integration of financial markets could not occur without integration of telecommunications networks, a product of technological innovation and international cooperation.

U.S. Leadership

Perhaps nowhere has the United States been further ahead, and yet more isolated, than in the promotion and successful use of both facilities-based and resale competition between and among transmission media to support its domestic as well as the global economy.

Technological innovations, including the conversion from analog to digital transmission technologies, fiber optics, the merger of telecommunications and information processing, integrated services digital networks (ISDNs), and inter-satellite links make network integration easier. They also render unnecessary many previous government policies and regulations that mandated facility availability and use.

U.S. telecommunications policy now encourages private entrepreneurs to construct new facilities that compete for new business internationally with traditional monopoly cables and global or regional satellite cooperatives. Facilities-based competition stimulates service diversity, efficiency, and heightened customer welfare. NTIA has supported the elimination of government monitoring and intervention in the precise allocation of traffic between cables and satellites. An end to unnecessary government intrusion into many facilities planning and circuit loading decisions supports innovation and the ability of users to choose the transmission medium and service that best fits particular needs.

In the future, we can expect some countries to permit limited competition with their international carrier, now typically a monopoly. Liberalization is occurring and is most likely to occur at the margin, in the area of enhanced services, for example, where communications capacity is leased from a carrier and value (i.e., features) is added to the basic circuit.

If history is prologue, however, most foreign governments will maintain strong ownership and regulatory controls, and periodically intervene in markets. Such foreign government involvement should not forestall continued advocacy of procompetitive policies, however. In some instances, U.S. initiatives may be appropriate.

U.S. Government actions promoting competition in the international transmission market are the sort of constructive steps which both help our industries and promote competitive marketplace initiatives elsewhere. The President's November 1984 determination that U.S.-based satellite systems in addition to the global INTELSAT system are in the national interest has spurred a desirable reexamination of needlessly restrictive policies abroad. The U.S. decision to sanction private transoceanic communications cables has also had positive effects. Cooperation, however, is intrinsic to international communications. Again, while it will be possible to accomplish some industry and regulatory changes, progress in other areas is likely to prove significantly slower than was the case in U.S. domestic long-distance communications markets.

Facilities Competition

U.S. promotion of facilities-based international competition has caused some foreign government concern that market entry will lead to overcapacity and the need for carriers to cut prices. Telecommunications administrations abroad worry that the proliferation of facility options could produce "destructive competition." This, they argue, could jeopardize investment plans, and reduce the contribution that international services reportedly make to maintaining domestic telephone prices at reasonable and affordable levels. Some developing countries, moreover, reportedly rely heavily on the profits from international communications traffic to support ongoing modernization of their domestic telephone networks.

U.S. cable and satellite entrepreneurs, despite the service diversification and price competition they bring to the international communications market, are perceived as a threat in many quarters, rather than a means of stimulating overall demand and thus additional revenues. The assumption on the part of some communications administrations abroad appears to be that competitive U.S.-based entry should be avoided.

All indications, however, are that the international communications status quo will become increasingly difficult to sustain in any case. As telecommunications and information become a larger part of their operating budgets, and more critical to their commercial success, sophisticated multinational corporations are less apt to acquiesce to the traditional slow pace with which new communications services have been offered in many monopoly markets. Major users have, and will increasingly "vote with their feet" to locate new businesses in nations with progressive and flexible regulation. Artificial constraints on competition and technological innovation may yield short-run profits, but only at the expense of potentially serious traffic losses and other adverse economic effects downstream.

The days are limited where international communications facilities can be planned and deployed on a coordinated, often cartelized basis, and customers can be effectively denied alternatives. Once alternatives are available, any regime grounded on price and service discrimination will become increasingly hard to sustain.

Established international telecommunications entities will have to make substantial adjustments to accommodate greater facilities-based competition and the ability of users to avoid traditional service restrictions. In this regard, it is important that price and service competition be permitted.

Inherent in policies favoring competition and customer choice is the need for marketplace forces to guide the development of markets to the maximum extent possible. Policies which seek to protect competitors from fair, cost-based competition can adversely affect the efficient development of a market as much as policies which seek to forestall competition altogether. Striking a sound balance between the need to encourage price and service competition, while minimizing any risk of anticompetitive monopoly pricing, will likely prove no easier in international markets than it has in domestic communications markets. Competition requires actual or potential competitors. If we err, however, we should err in favor of the benefits of price competition. The fundamental objective, in short, should be to foster competition, not individual competitors.

International ISDN

The much-heralded conversion of the international telecommunications infrastructure from analog to digital technology could make it easier to conduct international commerce through more efficient and less expensive telecommunications. Some questions arise, however, whether proposals to develop international integrated services digital networks (ISDNs) have sufficient support in the market. Additionally, the advent of networks which combine a diversity of services and functions may necessitate a reappraisal of a number of prevailing communications policies and regulatory conventions.

Some U.S. policies are premised on distinctions which ISDN could render obsolete. In an all-digital environment, for example, differentiating between voice, data, and video traffic will prove difficult. Additionally, U.S. policies have been based on establishing regulatory lines of demarcation between network facilities and customer-premises equipment. More recently, the AT&T antitrust consent decree also sought to limit the functions which could be provided within the public-switched telephone network. Because ISDN typically entails establishing a very feature-rich network, however, such boundaries and limitations could also be rendered irrelevant. Finally, inherent in the concept of ISDN is a possible impact on past U.S. policies that stressed customer sovereignty, and the ability to buy what is wanted, and to pay only for that. A full-fledged ISDN may offer an array of communications options only a minority of customers want or need, and yet the cost of those options might be borne by all subscribers.

The proliferation of ISDN services creates further pressure on nations to resolve diverse views on how international regulations should address the convergence of telecommunications, information processing, and video services. For more than 20 years, the FCC has sought to devise means of ensuring effective, but minimally intrusive, common carrier telecommunications regulation, while also exempting information processing from regulatory constraints, even when such services use telecommunications facilities. A separate regulatory and legislative regime exists for video services, where direct competition between cable television and telephone companies is now generally prohibited.

Notwithstanding the difficult legal and regulatory questions which ISDN developments raise, it is important that such developments be allowed, indeed encouraged, to evolve. Such offerings have substantial promise in terms of new services and additional customer choices. The technical and other challenges associated with developing such sophisticated new computerized communications networks are also substantial. As previously discussed, all commercial and demographic trends, particularly in the United States, mitigate in favor of new demands materializing and, in some cases, relatively quickly. As business and residential demand for new computer-communications services materializes, it is important that public networks be able to accommodate those new demands.

For businesses, ISDN may achieve a merger of previously discrete voice, data, and video networks, and afford greater network control from user premises. ISDNs will make switching, virtual networking, number identification, and call routing faster, easier, and potentially less expensive. For residential users, ISDN may bring more of the benefits of the information age to the home via modemless terminals, videotext, and new video entertainment options.

The ITU will face some of these policy challenges in the course of the World Administrative Telegraph and Telephone Conference ("WATTC") which convenes in Australia in November, 1988. At the WATTC, and subsequent conferences throughout the remainder of this century, U.S. and other countries' policies favoring deregulation and competitive provision of telecommunications and information services will challenge other nations' interests in providing telecommunications administrations a broad sanction to provide additional services on a monoply basis. It is important that the United States be prepared to meet these challenges.

Parity in Facility and Service Matters

Many foreign nations currently deny or restrict U.S. investment in foreign carriers, or bar establishment of an operational presence, notwithstanding the opportunity afforded their companies to participate in the U.S. domestic market. While many nations have agreed to accept and deliver U.S. telephone traffic originated by carriers other than AT&T, none has agreed to permit their citizens the option to select such foreign carriers for routing return traffic to the United States.

Few nations permit alien ownership of even a minority share in a domestic carrier. But the United States now allows unlimited foreign participation in ventures that operate without frequency spectrum, such as fiber optic cables, and permits minority foreign investment in facilities that use frequency spectrum, satellite and microwave carriers, for example. The United States also allows foreign-based firms to compete in its domestic telecommunications equipment markets with virtually no government limitations.

Freedom of international investment is a cornerstone of U.S. economic policy. Maintaining our policies of freedom of investment may become more difficult, however, absent steps overseas which, in actuality, open markets and accord U.S.-based communications and information companies mutually advantageous market access.

International Spectrum Allocation

Increasing demands for frequency spectrum and orbital "parking places" for geostationary satellites are placing strains on the international regulatory system that controls use of these resources. New ways to position satellites more closely, and to derive additional communications capacity from them, have made it possible to accommodate requirements in the past. Some countries fear that in the future, however, the cost of technology to accommodate additional congestion may rise to prohibitive levels, and some developing countries have renewed efforts to secure more rigid allocation schemes.

Allocating resources among nations is a demanding test of global cooperation and compromise. To date, the ITU has successfully refereed frequency and orbital slot assignment disputes. Many nations, however, oppose the current "first come, first served" system as inequitable. Others, including the United States, believe that strict and absolute allotments will reserve resources in perpetuity without certainty of use as technology improves efficiency.

The United States has proposed a hybrid system that allots some resources to specific nations, while leaving other resources available to all which follow the customary procedure of registering a use in advance, and coordinating it with nations that have identified the potential for interference. Over coming years, however, continued pressure can be expected on developed countries at various ITU conferences to share finite radio spectrum resources with developing nations. (See Appendex A for a general discussion of the spectrum allocation process.)

Standards Development

Telecommunications standards development traditionally has been the realm of engineers and technocrats. Increasingly, however, national industrial interests and higher economic and commercial stakes have made the process more political, and thus commanded greater attention by senior policymakers around the world. (See Appendex B for a general discussion of the standards-setting process.)

In the past, standards issues were less complicated. The technology was less complex, and production economics often tended to limit the range of practical approaches. As telecommunications technology becomes more complicated, however, and production economics also change -- in part because of computerized manufacturing processes -- standards become more amenable to deliberate manipulation.

Standards can promote one nation's vision of how to deploy technology at the expense of others. We can thus no longer simply assume that an agreed-upon standard necessarily will optimize efficiency, global connectivity, and the balance between cost and features.

At the same time, the failure to reach a rational and ubiquitous standard can have a harmful affect on manufacturers and users in many ways including:

- A large, homogenous market might have enabled manufacturers to achieve economies of scale and users would have benefited with lower unit costs;
- International services cannot function optimally without "seamless" interconnection of various networks controlled by different carriers operating in different nations; and
- Information-intensive applications could become too time consuming and inefficient, perhaps requiring users to consider non-telecommunications alternatives, e.g., on-site processing or physical delivery of data.

Experience indicates that standards have been used to reserve markets for particular firms and to limit competition. The proliferation of several television broadcast and receiver standards, for instance, has meant that any one nation's equipment industry must commit to a single standard, or expend the additional resources to accommodate several different product lines. In telecommunications, the U.S. decision to commit to a broadband "T1" digital transmission standard at 1.544 megabits per second (Mbs), for example, while much of the world chose a 2.048 Mbs standard, has confined U.S. manufacturers to the domestic market, or required additional experience and engineering for additional export-only product lines. It must be kept in mind that the United States market is generally large enough for others to accommodate to our standards, while other markets are sometimes too small for our companies to act similarly.

Future Standards Issues

Between now and the year 2000, global standards development forums will need to address, among other items, ISDN, digital telecommunications, and High-Definition Television (HDTV) standards. Billions of dollars in future equipment and service sales are at stake. How decisions are reached, and whether functional standards can be established, will depend on how aggressively nations pursue narrow short-term interests at the expense of the greater international and mutual good.

The Standards Setting Risk for HDTV

The HDTV standards development process provides a good study of the political, economic, and policy stakes. As this nation begins to appreciate the potential impact of a largely foreign-dominated advanced television marketplace, research and development expenditures have risen. Some also urge government intervention to forestall the potential for market manipulation by foreign governments and manufacturers.

U.S. Government policymakers, domestic television broadcasters, cablecasters, video program producers, and prospective HDTV manufacturers among others, must consider the consequences of a foreign head start. They must also assess whether efforts should be made to catch up generally, or whether the United States should concentrate on competing in parts of the overall future market.

HDTV standards development demonstrates how important it is for nations to get involved at the highest levels early in the process and to remain committed throughout.

Telecommunications Equipment and Services Trade

Discussions on international telecommunications have consistently indicated substantial concern about the present and future U.S. balance of trade in telecommunications equipment and services. Since telecommunications constitutes the conduit through which most international commerce is conducted, trade in telecommunications equipment and services will become an increasingly significant force in the 21st century economy.

Our pluralistic, procompetitive industrial policies are strongly at odds with some of the methods which have enabled other nations to generate communications trade surpluses. We must vigorously respond to nations whose protectionist and anticompetitive practices unreasonably restrict or prohibit market access. At the same time, we should avoid the temptation to mimic such foreign practices.

The U.S. Government will continue to work closely with the private sector to identify and remedy market problems, whether economic in origin or the result of foreign government market intervention and discrimination. Once identified, such issues should be the focus of active government efforts to resolve them. This will require the allocation of sufficient personnel and other resources to analyze claims of harm, and to engage the responsible foreign governments in forthright dialogue.

Throughout the remainder of this century, U.S. trade and telecommunications policymakers will have to work under complicated circumstances to seek greater adherence to free market rules. The United States must redouble its efforts to persuade others of the soundness of open markets in the face of foreign concerns for their national security, privacy, economic welfare, and cultural sovereignty. Fortunately, the prospect of significant free trade alliances in telecommunications with resulting service and price benefits, will cause countries that practice protectionism such difficulties that many protectionist barriers will dissolve at an accelerated pace.

Contemporaneously, steps should be taken to revise or eliminate domestic policies, laws, and regulations that prevent U.S. industry from expanding into the international marketplace. Such changes should include the AT&T consent decree, which now limits the ability of Bell companies to become full international market competitors by allowing only manufacturing abroad for foreign markets, for example, even where the domestic market for such equipment is competitive. Current antitrust restrictions which prevent procompetitive collaboration among U.S. companies to achieve a sufficient critical mass of expertise and financial resources to serve international markets should also be reviewed.

Conclusions

- America's relative economic, political, and cultural strength in the year 2000 will be significantly affected by the vitality of its telecommunications and information sectors.

- Today, almost for the first time in its history, the United States faces strong challenges to its technical and commercial leadership in telecommunications.

- Increasing global telecommunications interdependence and movement in other countries toward more competition are currently juxtaposed with national industrial policies which seek to forestall foreign access to domestic markets while targeting foreign markets for subsidized entry.

- Issues concerning communications infrastructure development, standards development, research and development, and spectrum resource allocation have a direct effect on our international trade balance in telecommunications equipment and services.

- There is a need for substantially greater U.S. government participation in international telecommunications and information arenas, including international radio spectrum regulation, associated multilateral discussions regarding satellite orbital use, standards development, communications trade policy, and foreign market access.

- The view of international telecommunications in the next century is affected by what we do now to forestall a deteriorating trade posture. Existing trends cannot continue, lest we lose international technological and policy leadership. It is essential that telecommunications become a part of the national agenda, not simply a subject for interest group maneuvering.

Recommendations

- Affected industries and government should commit sufficient personnel and other resources to develop a steady, expert, and persistent presence in international forums that address resource allocation, standards setting, regulatory, and trade issues. To do otherwise is to allow the international telecommunications marketplace to tilt increasingly to foreign players.

- The United States must build on recent successes to achieve a better understanding of when to emphasize which approach and at what forums. Unilateral actions, such as the AT&T divestiture, did not make the international telecommunications marketplace more accessible for U.S. manufacturers, even as the U.S. market opened to greater penetration by foreign manufacturers. On the other hand, our initiatives to promote facility and service competition helped our nation while encouraging other nations to privatize their telecommunications industry or to permit some facility and service competition.

- Additional bilateral actions involving the United States and a few progressively minded nations can serve as the foundations for future multilateral agreements. What the United States and the United Kingdom agree to regarding international value-added networks, for example, will have a substantial impact on what other nations can accept in global forums such as the ITU-sponsored World Administrative Conference on Telegraph and Telephone.

7

Privacy, Information Flows, and Protection of Intellectual Property in the Information Age

By the turn of the century, what technology will enable us to do with information will have profoundly changed our lives. Individual, business, and national prosperity will hinge, to a significant degree, upon the ability to use and control information. It is becoming a hackneyed phrase, but nevertheless it is tomorrow's reality: the advent of the information age stands to revolutionize our way of living as much as the industrial revolution altered the agrarian society which preceded it.

Computers and telecommunications technology will permit more individuals and businesses to operate from their homes or from a number of remote locations. New telecommunications network capabilities and innovative services will also provide individuals the ability to select, edit, and print verbal, audio, and video information -- to become "electronic publishers." These and other developments will likely have consequences that could significantly affect traditional concepts of privacy, and ownership and control of intellectual property. Conceivably, they could substantially alter the relative roles of creators, distributors and users of arts, entertainment, information, and data.

In earlier times, written information and oral communications could be controlled by the speaker or publisher more easily. Unauthorized copies of books and maps could be made and secrets could be violated, of course, but access to information was generally limited to the circle of users selected by the speaker or publisher.

Electronic transmission, however, has vastly increased the potential for unintended use of information. This has caused concern, particularly where prior experience had caused people to develop an expectation of either privacy or unrestricted use with respect to the information in question. Many owners of home satellite receivers, for example, both in the United States and abroad, view unencrypted television network "feeds" relayed via satellite which are not intended for public reception, but rather for processing and subsequent distribution through network studios. More ominous is the demonstrated ability of computer hobbyists and others to gain unauthorized and potentially destructive access into corporate databases and networks, and even the public-switched telephone network. The vast amount of information handled by telecommunications and computer networks, coupled with the ease of access and speed with which volumes of data can be copied, altered or erased, heighten the importance of information policy issues as we approach the 21st Century. Thus, issues such as privacy, security, international control of information flows, and definition and enforcement of intellectual property rights (e.g. copyrights, patents, and trade secrets) have become more important to individuals, businesses, and Government -- and promise to be even more important in years to come.

Information Policy Must Balance the Rights of Individuals and the Welfare of Society

Information policy issues often arise out of a tension between individual or corporate property rights, and conflicting needs or desires of society. In the late 1970s and early 1980s, for example, individuals who purchased home satellite receivers at a cost of $2,000 to $15,000 were initially able to freely view satellite-transmitted video programs, by intercepting over-the-air satellite signals intended for cable systems and broadcast stations. When the affected industries asserted that such viewing infringed upon ownership rights of programmers, many who had installed satellite receivers claimed a right to view any programming they could pick up. Congress was enlisted to balance these conflicting claims, and ultimately allowed dish owners to receive and view such unencrypted signals. On the other hand, courts have held that government may limit the accessibility of information considered obscene, or which would jeopardize national security. Thus, information policy addresses, in general, issues surrounding both the flow of information and the controls which are sometimes thought necessary to direct that flow.

Fundamental National Policies

Our democratic tradition rests on longstanding and familiar assumptions that the American public and, ultimately, the national interest, will best be furthered by encouraging the maximum range of information options -- the ability of everyone to choose freely among diverse and antagonistic sources of news and information.

The challenge for communications policymakers in the past was two-fold. On the one hand, the impact of electronic information services, broadcasting especially, was plainly growing. On the other, regulatory and other factors were limiting the number of information suppliers, and thus limiting the proportion of the people who could express their opinions and ideas through electronic media. Concern with respect to control of information and information flows, in short, was growing as was the importance of information to the country.

Government faced a fundamental choice between embarking on more intensive regulation of information suppliers, versus taking steps to increase their number. It chose the latter, a course facilitated by changes in technology and costs that made competition among existing and new suppliers of information feasible.

As policymakers seek, in the coming decades, to maintain an appropriate balance between individual freedoms and societal interests, they should continue to encourage even more diversity, both in the sources and nature of information available. Policies promoting competition are highly desirable in this regard, as First Amendment and competitive values are closely related. Both seek to allow the maximum number of participants, and in so doing, to minimize the control which any one participant, including the government, may command.

The "free market of ideas" which Mr. Justice Holmes wrote about some 70 years ago is undeniably essential to the effective functioning of our democracy. It is most likely to be ensured by fostering diverse sources of information.

Information Issues for the 21st Century

As electronic transmission of information becomes more efficient and ubiquitous, new opportunities and challenges will arise. Two trends in the transmission of information in particular will need to be assessed in terms of their possible effect on information policies: (1) even as the costs associated with transmission decline, the *value* of the information transmitted is increasing; and (2) as technologies proliferate and become more versatile, information becomes more accessible.

These trends generally increase conflicting pressures: on the one hand, proprietors of increasingly valuable information seek to restrict or control access to it and, perhaps, to raise the price of such access. On the other hand, users and others desiring access to information have greater incentives to find a way to overcome such restrictions as the value of information increases. Additionally, public policies may affect accessibility of information because of First Amendment concerns or international relations, apart from marketplace forces.

The range of issues grouped under the term "information policy" has changed over time and undoubtedly will continue to evolve as we approach the 21st Century. As we look towards the year 2000, some of the most important issues in information policy can be broadly categorized as follows:

- protection of personal privacy in light of data collection, manipulation, and dissemination by government and private firms, and the sometimes related need to ensure security of some information;
- "free flow" of information across national boundaries; and
- intellectual property rights and limitations, both domestic and international.

The balance of this chapter takes up each of these areas, briefly describing how they might evolve in the 21st Century. It may not be possible or advisable for government to attempt to manage each of these areas of information policy. It is important, however, for government to remain knowledgable and ready to respond where appropriate.

Information Access and Dissemination

As technologies create new means to access, manipulate, and disseminate information, economic opportunities will increasingly arise for individuals, firms, and government to profit. In some instances, however, other individuals or companies would rather not have this information collected, used, or disseminated. Whether there should be legal means available to prevent (or prevent interference with) such collection, use, or dissemination will be one of the key questions posed to citizens, Congress, and other governmental bodies.

Establishing Reasonable Standards

What may be the most formidable challenge for information policy will be the necessity of drawing lines between permissible and impermissible information access and dissemination. Judgments ultimately will rest with citizens, who will make their views known through their purchasing decisions, through their elected officials, and through their lawyers.

Consumers today have opportunities to limit the use of their names and addresses when credit-card companies or mail order houses sell their mailing lists. If enough consumers express privacy concerns, it is conceivable these and other firms will offer confidentiality of subscription and billing information as a marketing tool.

Alternately, where market forces appear insufficient to strike an appropriate balance between user needs and societal goals, elected officials at the local, state, and Federal levels will be called upon to legislate such a balance. For example, when copyright owners in the recording industry objected to stores that rented records and tapes and, in some cases, sold blank tapes and made recording equipment available on the premises, Congress passed legislation which virtually eliminated the commercial audio taping industry. Although some considered this to be anti-consumer legislation, it was evident that the rental of audio recordings had harmed the recording industry by reducing the number of releases during the years audio rental existed, thus ultimately risking greater harm to the public.

Safeguarding Privacy

Privacy issues have arisen since well before the founding of this nation. Indeed, the Fourth and Fifth Amendments to the Constitution are intended to protect individuals against certain physical intrusions affecting them or their property. Legal scholars long ago articulated the individual's "right to be left alone," and that concept has since been recognized by the Supreme Court as an important national value.

Communications and Information Focus

Although the concept of privacy has been central to debates over issues ranging from search and seizure to personal practices and reproductive rights, privacy issues in the context of telecommunications and information policy are considerably more focused. The focus here has been, first, on the interception of private electronic communications, or what in the context of traditional voice telephone calls was referred to as "wiretapping." This concern has expanded with the advent of new technologies and the growth of services such as cellular telephones, electronic mail, facsimile transmissions, and the networking of computers.

The second focus has been on the collection, use, and dissemination of information in the home, the workplace, or by Government or quasi-government agencies. This second group of issues is sometimes called "records privacy." An individual's concern about the collection and distribution of sensitive or revealing personal information such as financial or medical records may be two-fold: the loss of control over information once it has been disclosed, and the accuracy of that information as it is distributed and redistributed.

Interception

Interception of private communications has long been the object of Federal and state protection. The Fourth Amendment to the Constitution, supplemented by wiretapping, postal, and other statutes, placed strict limits on wiretapping, electronic eavesdropping, and the opening of mail by government agencies, as well as protecting against many such acts by private individuals. As technology changed, there was a perceived need to update applicable statutes to provide similar protections for these newer means of communicating. The industries involved themselves recognized that such protections could be "good business," and could avoid a possible consumer backlash against use of such new systems if they felt unprotected. These developments led to the Electronic Communications Privacy Act of 1986, which updated the wiretap laws to cover these new technologies. As communications technology continues to evolve in the 21st Century, we can expect similar evolution in these types of protection.

Government Recordkeeping

With respect to records privacy issues, 21st Century policymakers should continue to distinguish between two areas: first, the collection and use of information about individuals by government, and second, the collection and use of information by private firms for commercial purposes. The Federal Government's collection and use of information about individuals is addressed primarily by the Privacy Act of 1974. At the heart of the Privacy Act lie general information principles including: (1) there should be no secret record systems; (2) individuals should be able to see and correct records about them; and (3) information collected for one purpose should not be used for another.

The procedures by which individuals may gain access to certain records kept by the Government (with some important exceptions such as records pertaining to national security, trade secrets, or privileged or confidential information) are described by the Freedom of Information Act. For example, individuals may seek to block others' access to "personnel and medical files and similar files kept by Government the disclosure of which would constitute a clearly unwarranted invasion of personal privacy." The practice of "computer matching," or comparisons between databases, is the subject of pending legislation that would establish procedures and safeguards. The Government's collection and use of information has spawned court cases and will, in all likelihood, continue to be an important area of information policy.

Recordkeeping By Private Industry

Privacy concerns with respect to recordkeeping and the use of information by private industry began attracting political attention in the early 1970s. Congress thus far has addressed such privacy issues on a sectoral basis.

Some information policy experts argue that the United States should follow a different model and attempt to craft omnibus recordkeeping legislation that would apply across the board to many industries and types of records. This is a model employed in other countries. On the other hand, the U.S. experience has demonstrated that it is generally better to tailor safeguards for use in affected industries.

Congress and the public have proven capable of recognizing, and in an effective, targeted way, solving problems as new industries or services have developed. For example, important pieces of privacy legislation have been passed affecting several sectors including: credit reporting, financial services, cable television, and certain electronic transmissions. Such a targeted approach, which responds to specific problems and the unique characteristics of an industry, is less likely than omnibus, "least common denominator" legislation to retard the development of new and socially useful industries and services. Brief descriptions of some of these laws will illustrate the kinds of specific protections devised by the Congress:

First, credit investigation and reporting agencies must: (1) make their records available to the subject (although they do not have a duty to tell an individual when he or she has become the subject of a credit check); (2) establish procedures for correcting information; and (3) disclose information only to authorized customers. One large credit reporting company is affirmatively contacting individuals about whom it has records, and for a modest charge providing them with a copy of the records and notification when inquiries about those records are made. Such an action would appear to be in anticipation of public privacy concerns, in addition to any pecuniary or other benefit to the firm.

Second, individuals are protected from unwarranted government access to personal financial records under the Right to Financial Privacy Act of 1978. Additionally, financial institutions providing electronic funds transfer services are required to notify customers of any third-party access to customer account information.

Third, privacy provisions of the 1984 Cable Act require a cable television system operator to inform subscribers of the nature of personally identifiable information collected by the system operator, and other details of how and when that information will be used. The law also restricts the kinds of information a cable operator may collect or disclose, and requires the cable operator to destroy data after its use.

Fourth, electronic communications such as cellular radio, private satellite transmissions, paging devices, digital communications, and other computer-to-computer data transfers are protected from unauthorized private and governmental interceptions. Service providers making unauthorized intentional disclosures of confidential communications may be subject to a civil lawsuits and criminal sanctions may be imposed for intentional interception, impermissible access to stored data, or disclosure.

As these examples illustrate, when specific activities are widely perceived as transgressing personal privacy bounds, it is likely the public and their elected officials will respond. For example, when a Federal judge was under consideration for appointment to the Supreme Court in 1987, a Washington, D.C. newspaper carried a story revealing the record of the nominee's videotape rentals at a home video store. Within weeks, bills had been introduced in Congress to prohibit video stores from divulging customer records.

Security of Information

A separate, though related, issue arises when information required to be held securely is disclosed more widely than the holder and subject wish, because the storage or transmission of the information, or both, is not secure. One way to maintain security is to destroy information that is no longer needed. To date, the Cable Act is the only legislation that requires that personal data be destroyed after its use.

Maintaining security of computer databases is often a necessity for private firms because of their proprietary nature. Companies increasingly take steps to limit the number and identity of people with authorized access, employ the use of passwords and "locks" on databases, and develop other security plans. Where the information collected is not directly related to the financial condition of a firm, but may still contain sensitive material (e.g., individual records), security measures may also be essential. In the areas of electronic funds transfer, securities and commodities trading, and other electronic transactions which may be targeted for financial gain by interceptors, security is of critical concern. The Congressional Office of Technology Assessment has noted that:

> *[t]here is a blend of optimism and pessimism in the computer technology community about the future of computer security problems. On the one side, experts correctly point out that the technology of securing computer systems is improving steadily...[and that] computerized systems, even if not perfectly secure, are often far more secure than the manual systems they replaced.*
>
> *On the other side...since security has not been historically a high-priority goal in the design of information systems...security hardware*

> *and software are often added as an afterthought rather than integrated into the system from the beginning. [Further,] advances in the technology of protection may not be adequate to deal with the complex systems now being built.*

Through a combination of improvements in security technology and specific legislation where needed, adequate safeguards should be established to protect against unauthorized access and misuse of information. Congress, for example, passed legislation to address liability where unauthorized electronic funds transfers occur. This may be a model for measures in other areas.

The problem of the security of information goes beyond unauthorized access and use. Unauthorized access and alteration or deletion of data or records has also become a significant concern. Our increasing dependence on electronic records systems for crucial purposes, such as financial transactions or payroll records, increases the damage that can be done, purposefully or through modern forms of vandalism. There have been discussions, for example, of hospitals concerned that they might administer the wrong drugs to patients, or even be forced to shut down, if someone were to access and alter their electronic records.

We may be aware today of only a fraction of the potential risks involved in global, instantaneous, high capacity networks combining voice and data transmission with computer access and control. The telecommunications industry has long been affected by fraudulent use of networks by computer hackers, "blue boxes," and the like. Nor is this necessarily an exclusively American problem. Government agencies in Japan and West Germany, for example, currently are exploring means of cost-effectively minimizing such abuses. This is an area where more effort, including inter-governmental discussions, may be needed.

Future Privacy Priorities

Citizens, businesses, and public agencies are embracing the technologies of the information age. They welcome the improved speed, quality, and new capabilities these electronic communications technologies and services can provide. People are increasingly aware, however, that as access, manipulation, and dissemination of information becomes both easier and more profitable, the opportunities for abuse of information also are enhanced.

Reaching a Sound Balance

It is not yet clear what activities citizens will perceive to constitute an unwarranted abuse of privacy, nor whether they will assume that reduced privacy is one of the unavoidable tradeoffs to enjoy the fruits of the information age. It is essential, however, that individuals become sufficiently informed about the capabilities of telecommunications and data processing systems to make informed choices, and where necessary, to guide elected officials in legislating necessary privacy protections.

In pursuing the goal of adequate security and privacy safeguards in the 21st Century, there likely will arise both technical and marketplace solutions to the problems of unwanted use and misuse of information. Additionally, the trend toward assuring individual protection evident on the part of Congress (as well as state legislatures and other governmental bodies) should continue.

Technological Remedies

Markets, and particularly unregulated markets, can be tremendously resilient and creative, and provide solutions to difficult problems. In the area of new technological solutions, for example, film and home video producers are hopeful that a new technology called "macrovision" will permit prerecorded video cassettes to be encoded so as to prevent unauthorized copying. Whether further legislation will be passed, given these market developments, is thus uncertain.

A second example illustrates that markets can also respond to public concerns, in this case, increasing demand for construction of "Sensitive Compartmentalized Information Facilities" (SCIFs). These ultra-secured rooms in office buildings are needed, for example, by firms intent on maintaining security of information. As one report noted,

> *Regardless of the high construction costs ... builders, architects and commercial real estate specialists said there will be a need for SCIF space as long as there is the need for companies to perform classified research.*

These examples serve to illustrate an important point. The "electronic tools" made possible by technology can also make possible new ways to enhance privacy and information security.

Finally, we have no reason to believe that Government will be any less willing or able to address privacy and security concerns with legislation where appropriate than has been the case in the 1970s and 1980s. Not every legislative proposal becomes law, of course, but the track record of successful Congressional actions targeted to problems in this area has been impressive thus far and argues against attempts to find an all-encompassing omnibus approach. As noted earlier, an omnibus approach risks stifling the development of technologies with enormous potential for constructive use.

Ensuring Free Flow of Information

The globalization of markets has been expedited by advances in technology which permit firms to communicate more quickly and completely and efficiently throughout the world. In turn, advances in technology have been spurred by increased demand in world markets. Without doubt, the amount of information transmitted across national borders has grown enormously.

U.S. Commitment

Since the end of World War II, the United States has advocated a policy of "free flow" of information, goods, capital, and labor throughout the world. The policy of free flow has been variously defined, often meaning:

- o An extension of the First Amendment prohibition against laws "abridging the freedom of speech, or of the press," and in the sense expressed by Article 19 of the Universal Declaration of Human Rights;
- o The absence of impediments imposed *inadvertently* as a consequence of regulations not directed at information flows per se;
- o The absence of laws or regulations that *intentionally* impose restrictive conditions on the location of data-processing facilities, or on the transmission beyond borders of certain kinds of information (the motivations may be purely economic and not political; content may be of no particular concern to the regulators);
- o The absence of governmental attempts to require disclosure -- for economic, social, or political reasons -- of the content of information being processed or transmitted.

As other countries, the United States has acknowledged limited exceptions to the general principle of free flow with respect to privacy, intellectual property rights, and national security requirements. The United States should, however, continue to advocate the basic principle of free flow of information in its international telecommunications and information policies.

This longstanding policy yields important economic and non-economic benefits. First, U.S. firms have been able to operate in other countries because essential communications activities can be carried on across borders. As world markets become more competitive, U.S. firms will require even better worldwide communications capabilities. Advanced technology will not suffice if countries limit the ability of firms to transmit data and other information into and out of their territory. Second, free flow of information maintains a robust marketplace of ideas, contributing to the ability of citizens of the United States and other countries to communicate and resolve issues effectively.

In recent years, although the free flow concept has been defined variously by different governments, a consensus has been evolving that the global benefits of unrestricted flows of information warrant maximum flows of information among countries. One important breakthrough was the 1985 Declaration on Transborder Data Flows, adopted by the Organization for Economic Cooperation and Development (OECD). As noted by the OECD, this "Data Declaration" was the:

> *first international effort to address economic issues raised by the information revolution. It addresse[d] the policy issues arising from transborder data flows such as intracorporate flows, computerized information services and scientific and technological exchanges...."*

In the data declaration, the OECD members stated, among other things, that:

> *...national policies which affect transborder data flows reflect a range of social and economic goals, and that governments may adopt different means to achieve their policy goals;*
>
> *[Members are] aware of the social and economic benefits resulting from access to a variety of sources of information and of efficient and effective information services;*
>
> *[and] ... that Member countries have a common interest in facilitating transborder data flows, and in reconciling different policy objectives in this field.*

Therefore, "the governments of OECD Member countries expressed their intention to promote access to data and information, to develop common approaches for dealing with transborder data flows issues. They agreed to undertake further work on the main issues emerging from transborder data flows."

Information Flow Policies for the Future

While the OECD data declaration is a step in the right direction, not all countries share the spirit of cooperation evidenced there. In addition, each country's implementation of laws addressing information flows may subtly (or not so subtly) affect the degree of "free" flow. Quotas or other limitations on the number or value of film and video products used by many countries would appear not to conform to the spirit of a free flow policy.

Effects on Investment and Trade

Global trade can be adversely affected when trading partners have asymmetrical information policies. Imbalances in information flows across national borders may directly or indirectly offer firms from one country a competitive advantage over firms from another. The achievement and maintenance of unrestricted information flows is especially important as world markets become increasingly global. Manipulation of information flows must not be used as a weapon in world trade; rather, countries should recognize that they have a common interest in facilitating transborder data flows, and in reconciling different policy objectives regarding information flows.

Intellectual Property Rights

The creation and commercial use of intellectual property -- the subject of copyright, patent, trademark, service mark, and trade secrets law -- is playing an increasing role in the U.S. and world economies. This report focuses on copyright issues since they are the most related to the telecommunications and information industries, although most of the statements made here might apply to other areas of intellectual property.

Ensuring Adequate Protections

As previously noted, as technologies proliferate and advance, the information transmitted often becomes more valuable. Adequate intellectual property laws and enforcement of those laws are two necessary ingredients to ensure that creators have sufficient incentives to write, paint, sculpt, film, and record new works. If adequate protection and enforcement is not maintained, creativity will be discouraged, and incentives to produce will be reduced. In contrast, through strong intellectual property protections, there will be an expanding pool of creators and new works.

Striking a Sound Balance

In order to balance the rights of creators with the needs of users, the Congress through the copyright law has established important exceptions to practices that would otherwise constitute infringement. Perhaps the most important of these copyright exemptions is the "fair use" concept which permits private and noncommercial entities to use copyrighted works in a limited way without liability. One of the most well-known "fair use" exceptions has become the right of an individual to videotape copyrighted television programs for personal use -- a practice which, if strictly construed, would be a copyright violation. By the turn of the century, tensions between users and owners of intellectual property will, if anything, heighten and new conflicts such as the home videotaping controversy will have arisen.

Meeting Public and National Needs

Strengthening intellectual property protection must be high on the national list of priorities for the 21st Century. As the amount of video transmission capacity increases, it will become important to ensure adequate incentives to produce additional programming, in order to afford the public more choice. Additionally, the U.S. economy has become increasingly dependent on information-based industries.

Both the traditional copyright industries including publishing, motion pictures, and sound recording, and the newer information industries in the computer field, contribute significantly to the U.S. trade balance and Gross National Product (GNP). By one estimate, the information industry (television, recordings, movies, online service, radio, print services, newspapers, magazines, documents, and books) had revenues of $98.8 billion in 1984. Over the last 30 years, the copyright industries have contributed an increasing proportion of the GNP, as illustrated in the following table:

TABLE 1
Copyright Industries Contributions to the GNP

Year	Copyright Expenditures ($ Millions)	GNP ($ Millions)	(%)
1954	6,124	299,700	2.0
1980	121,398	2,631,688	4.6
1982	152,230	3,069,253	5.0

Protecting strong U.S. trade positions in industries based on intellectual property has become as important as reducing the trade deficit in goods, particularly in the telecommunications and information services sector. Indeed, the United States strongly supported the inclusion of intellectual property in the General Agreement on Tariffs and Trade Uruguay round of negotiations.

Both domestically and abroad, however, public understanding of the principles underlying intellectual property rights is losing ground to a widespread view that individuals have a right to reproduce works as they wish, particularly if it is easy and cheap to do so. A recent public opinion survey concluded, among other things, that the vast majority of the public finds acceptable -- such that they would be willing to do it -- some forms of unauthorized copying of copyrighted material. Copyright industries have sought to influence public attitudes about intellectual property. For example, the data processing industry distributed a brochure which read:

> *People who would never walk into a store and shoplift a software product think nothing of making several copies of the same software. The results are the same. The act is just as wrong.*

Within the United States, public attitudes and the heavy demand for entertainment products (e.g., video tapes, audio recordings) and computer software may pose the greatest obstacles to adequate intellectual property protection. Beyond our borders, however, additional complications arise due to the uneven and even nonexistent legal protection of intellectual property. The laws in many countries are either poorly enforced or have not been amended to reflect technological developments.

In addition, other governments employ various means to limit U.S. access to their markets. Five of the most common and serious tactics include:

1. Quota limitations on U.S. products -- laws may limit the number of titles imported or distributed or the number of prints or cassettes imported or distributed; laws may require an amount of "screen time" be devoted to national products; similarly, many countries require that a certain amount of broadcast programming originate domestically.

2. Inadequate intellectual property protection -- copyright laws may be unenforced, out of date, inadequate, or nonexistent, thereby permitting widespread piracy and counterfeiting.

3. Service barriers -- discriminatory laws may require that products to be exhibited in a given country must be printed or reproduced in that country or may prohibit U.S. firms from opening local offices for distribution.

4. Import Duties and Tariffs -- excessive and/or discriminatory tariffs are often levied on U.S. information products.

5. Subsidies -- governments create incentives by tax laws, loans, trade promotion agencies, and other means which favor domestic information products, to the disadvantage of U.S. firms.

One of the ways in which the United States has worked with other countries to support and strengthen intellectual property laws worldwide is through bilateral and multilateral agreements. Important bilateral agreements were made in the 1980s with Taiwan, Hong Kong, Singapore, and South Korea, and agreements were expected to be reached with Indonesia, Malaysia, and Thailand which would substantially reduce the amount of pirated and counterfeited goods produced in Southeast Asia.

Policies for the Future

Both domestically and abroad, the United States must continue to maintain and advocate strong intellectual property protections. Large scale piracy and counterfeiting must be curbed through vigorous government prosecution and punishment, as well as through actions taken by private firms to detect and stop such actions.

Perhaps more importantly, however, it is necessary for the public to appreciate that the unauthorized use of intellectual property is just as wrong as the unauthorized use of tangible property. The copyright law has carved out important exceptions to liability for certain, largely noncommercial, private uses of copyrighted works, and so strikes a good balance between the wants and needs of copyright holders and the good of society. It is fundamentally important that the link between intellectual property rights and the creation of more and different art, entertainment, information, and data be made clearer in the minds of all citizens. If individuals, particularly young people, do not respect intellectual property rights because they do not understand the vital function they serve as an incentive for creators and producers, government cannot force such respect on society. A workable copyright system is never enacted by law alone, experts have noted, but rather it evolves as a social system, which may be bolstered by law.

Conclusions

o By the year 2000, new telecommunications and information technologies and services will likely have consequences that could significantly affect traditional concepts of privacy, information flows and the ownership and control of intellectual property.

  The vast amount of information handled by telecommunications and computer networks, coupled with the ease of access and speed with which volumes of data can be copied, altered, or erased, heighten the importance of information policy issues as we face the 21st Century.

o Today, we may be aware only of a small part of the potential risks involved in global, instantaneous, high capacity networks combining voice and data transmissions with computer access and control.

o In pursuing the goal of adequate privacy and security safeguards in the 21st Century, there likely will arise both technical and marketplace solutions to problems of unwanted use and misuse of information.

o Congress and the public have proven capable of recognizing and solving privacy problems in a targeted way as new industries and services have developed.

o With respect to international flows of information, other countries have policies different from the U.S. and resulting global trade can be adversely affected by assymetrical information policies.

o If intellectual property is not vigorously protected, creative works will be discouraged and the incentives to make more will be reduced. In contrast, through strong intellectual property protections, there will be an expanding pool of creators and new works.

o Over the past thirty years, copyrighted intellectual property has contributed an increasing percentage of the Gross National Product.

o Both domestically and abroad, public understanding of the principles underlying intellectual property rights is losing ground to a widespread view that individuals have a right to reproduce works, particularly if it is easy and cheap to do so.

o Beyond our borders, additional complications arise due to the uneven and even nonexistent legal recognition of intellectual property, and laws are often unenforced or have not been amended to reflect technological changes.

Recommendations

- Individuals need to become sufficiently informed about the capabilities of telecommunications to make choices that reflect their level of concern about privacy.

- Government must remain prepared, if necessary, to act quickly and effectively to protect personal privacy and ensure information security. Specific legislative and judicial remedies should continue to be devised as warranted, rather than developing omnibus legislation.

- The United States should in all bilateral and multilateral relationships continue to promote the unrestricted flow of information (with internationally agreed upon exceptions) across national borders.

- Individuals and governments must recognize, and act in accord with the recognition that adequate intellectual property laws and enforcement of those laws are necessary to ensure an expanding pool of creators and new works.

- The U.S. government must adopt and enforce intellectual property laws domestically and must continue to work for stronger protection and enforcement by other countries to maintain a strong U.S. trade position and to promote the creation and dissemination of literary, artistic, musical, and other information-based works worldwide.

8

Television, Cable Television, and Radio Broadcasting in the Year 2000

Broadcasting and related services today represent the principal source of news, information, and entertainment for most Americans. The industry also serves as a critical component of the advertising business which plays a central role in marketing to consumers, and in helping fuel the economy. The industry, however, has undergone substantial change since the Rostow Task Force report was released. While that change has provided new services and program options, it has also put substantial pressure on traditional policies and existing regulatory mechanisms, and new directions are advisable. It is expected that this challenge will continue to occupy policymakers well into the 21st Century.

Broadcasting, and particularly broadcast television, has long been the predominant focus of American communications policy, chiefly due to its real and perceived impact on the public and, indeed, our overall national social, economic, and political life. It is also, as one Congressional leader once noted, virtually the only service in America that costs the public directly the same today as it did at its inception more than 60 years ago; that is, it is still essentially free.

America's fascination with television parallels, if not exceeds, that for the automobile. Experience indicates that U.S., indeed global, demand for video programming on the part of the general public is nearly limitless. A significant fraction of Americans today, for instance, not only have access to many over-the-air broadcast signals, but also subscribe to a multichannel cable television system or own a home satellite receiver, and have at least one video cassette recorder. Media scholars marvel at the apparent willingness of the public to purchase video products and services that, given time constraints, almost certainly exceed their ability to consume. This and other examples show a substantial propensity of the public to purchase electronic options. All indications today, moreover, are that our video marketplace will continue to generate additional options from which the public can and will choose.

Americans in the next century should enjoy an even greater array of electronic media and programming sources. Some gloomy predictions to the contrary notwithstanding, over-the-air broadcasting should remain a vital element of that national media mix, as few industries have demonstrated so consistent a talent and ability to deliver what the public and advertisers want. Broadcast television may experience further structural changes. Communications history, however, provides almost no instances in which an established business well-serving the public was actually eclipsed. It is conceivable that television may prove less profitable, but there is no good reason to assume that in coming years we will experience a market-driven demise of over-the-air video service.

Radio, which has successfully weathered a number of fundamental commercial changes throughout its long history, should also continue to command strong support. For our increasingly mobile society, radio demonstrably continues to provide valued services and an information immediacy which the American public plainly needs and wants.

Cable television will become increasingly important as remaining cities are wired, more households subscribe, and cable system channel capacities expand. High-powered, direct broadcast satellite services (DBS), and microwave-based multichannel multipoint distribution systems (MMDS), may provide additional competitive alternatives to cable television in some areas and for some households be the only source of "premium" video services.

Finally, the growing amount of fiber optic cable installed by local telephone, cable, and other companies, if accompanied by necessary advancements in switching and information storage equipment, could lead to the commercial provision of "video dial tone" service. This could give subscribers access, on demand, to a virtually unlimited library of video, audio, and data services. It would also contribute to the formation of an electronic "national neighborhood" that, through shared experiences and intercommunications, helps bring the American people and our communities closer together.

Television, Cable Television, and Radio Broadcasting in the Year 2000

The expected proliferation of distribution technologies and programming sources over the next several decades will continue the transformation of the media landscape which has occurred since the Rostow Report was released. In January, 1968, for example, 6,340 radio stations and 785 television stations (635 commercial, 150 public) were operating in the United States. By July, 1988, however, the numbers had increased to 10,330 radio (including 1,340 noncommercial FM stations) and 1,378 television stations (1,044 commercial and 334 public). As a consequence, some 71 percent of the nation's households in 1987 received at least nine television signals over the air. In the mid 1960s, only eight percent of households received as many signals.

Expanded Public Affairs Programming

Not only has the number of channels increased, but the quality of broadcasts has progressed as well. Some self-styled public interest representatives maintain otherwise, claiming there are fewer news and public affairs broadcasts today than in the past, but this facile assertion simply does not bear close analysis.

Local broadcast news shows have expanded, both in length and depth of coverage, in part due to electronic equipment advances discussed before. Each major national broadcast network today also airs regularly scheduled news and documentary programs and an increasing number of specials; indeed, a national network's news department's production, Sixty Minutes, consistently commands top ratings. Cable News Network, moreover, provides around-the-clock news service; another important cable service, C-Span, offers gavel-to-gavel Congressional and other political affairs coverage. The volume of international news and other programming routinely available has also greatly expanded. That critics do not understand or acknowledge these hard facts is grounds for concern. To paraphrase Will Rogers, perhaps of most concern is that what these critics think they know for certain, just isn't so.

Cable Growth

During these same two decades, cablecasting -- the commercial distribution of video programming by wire -- has also grown to challenge, if not surpass, over-the-air broadcasting as the principal means of delivering programming to the home.

In 1968, for example, about 2,200 cable systems served approximately six percent of the nation's television households. On average, those systems provided fewer than 10 channels of programming, and mostly retransmitted broadcast signals. Twenty years later, however, the number of systems has nearly quadrupled to 8,500.

The average system offers some 32 channels, of which less than half are broadcast signals. More than 80 percent of the nation's households have access to cable television, and more than half the nation's households subscribe.

New Technologies

While broadcast and cable outlets have grown sharply from levels attained in 1968, new technologies have appeared to further increase the distribution media available to consumers. Videocassette recorders (VCRs), for example, did not exist as a consumer product in 1968. Today, an estimated 65 percent of all homes, however, own at least one. Videocassette sales and rentals, moreover, constitute at least an $11 billion-per-year business, and there seems to be few families in America more than a short drive away from the neighborhood video store. While we tend to take this development for granted, it is conceivable that, in the future, observers will look back and see the development of the VCR and camera as a major event -- as the creation and popular distribution of a kind of "video printing press" which put perhaps the most powerful communications tool of the century at the disposal of the individual.

The development and spread of communications satellites, coupled with reductions in the cost of receiving equipment, have also enabled over two million households to receive multiple channels of programming. Most-home satellite receivers are in areas where broadcast or cable service is nonexistent or inadequate. At least one-fifth, however, apparently are situated in markets where there is significant video service already, again indicating strong demand in some quarters for more services and service options.

Programming Developments

This growth in media outlets over the past two decades has fueled, and has been in turn fueled by, a comparable increase in programming. In 1968, there were only three national programming networks, ABC, CBS, and NBC. This was due in part to the high costs of program distribution, which relied heavily upon conventional terrestrial facilities leased from telephone common carriers.

Satellite technology, by significantly reducing the cost of distributing programming over large areas, greatly facilitated development of new national programming ventures. By 1988, there was a fourth national broadcast network startup, for example, and more than 60 national cable networks. Over the same period, the programming and syndication market also developed to satisfy the programming demands of new networks, independent television stations, and the increasing number of other distribution outlets.

Benefits for Viewers

The dramatic growth of outlets and programming since 1968 has liberated viewers. They are no longer dependent on the offerings of a few programmers and outlets, but instead can choose from a large and expanding menu of program services and providers. The character of many of the new services, moreover, is different. In addition to still popular, mass-appeal programming, many of the new services are "narrowcast" and appeal to specific segments of the viewing audience, such as all-news, all-sports, all-old-movies, foreign language, and the like.

An increase in local outlets has produced diversity in local programming; now narrowcasting is also producing diversity at a national level, a trend which should continue. Indeed, the steady proliferation of distribution media and program offerings increases the likelihood that by the 21st Century viewers will have achieved full control over their television sets. They will be able to watch precisely what they want to watch, when they want to watch it.

Challenges for Public Policy

These dramatic and continuing changes in the media marketplace present challenges for policymakers to develop and implement new policies which better conform to the new reality of vastly increased competition, pluralism, and diversity. One major, pressing challenge is the simple need to review and alter the way in which government currently regulates radio and television broadcasting.

Conforming Regulation With Marketplace Reality

Notwithstanding a radically changed commercial environment, television remains the most regulated of electronic mass media. While overdue changes in radio broadcast regulation have been achieved in the past eight years, there remains a significant volume of government involvement in the diverse and highly competitive video business.

Policymakers must develop a regulatory framework which both recognizes new and evolving marketplace realities and affords broadcasters a full and fair opportunity to compete effectively in an increasingly competitive and dynamic media environment. Where competition can be reasonably expected to function as an effective surrogate for what regulation ideally might accomplish, government should not regulate and reliance should be placed on the marketplace. Additionally, imposing regulatory obligations on one set of players in a competitive marketplace, but not on others, has clear potential to distort the future development of the overall electronic media market.

Advertising, for example, constitutes one of the fastest growing sources of cable television system revenue today. Local television and radio stations, as well as national broadcast networks, thus compete increasingly with cable for audiences and advertising dollars. While cable and broadcasters are increasingly competitors in the same market, broadcasters remain subject to Federal licensing and other regulations which oblige them to air programming independent of marketplace demand. Reporting and other requirements are also imposed.

Legislation was enacted in 1981 which lengthened license terms to seven years for radio stations and five years for television. It reduced some of the regulatory burdens long visited on broadcasting. Regulatory reform initiatives subsequently have further lessened some costly obligations. Broadcasting nevertheless remains under many government regulations which are unnecessary and which are not placed on its competitors.

Consistent with good public policy, government should foster an environment conducive to maximum competition among firms which are similarly situated. Such a competitive market is more likely to ensure that the public has the options it wants and needs than even the most dedicated, well-meaning, conscientious government regulators can reliably accomplish. The predominant focus should be on fostering competition, however, not tacitly allocating markets or handicapping one or more groups of particular competitors.

Reforming the "Public Interest" Standard

Central to the prevailing broadcast regulatory scheme is the concept the government should, first, license broadcast stations in the "public interest," and second, somehow police their performance to ensure compliance with that elusive standard. Such an approach might have been considered sound in the past, when broadcasting constituted *the* electronic media and only a few "voices" were licensed to serve any given market. Conventional notions of "public trustees" entrusted with scarce resources and somehow commanding unique commercial power and persuasiveness, however, are increasingly hard to square with today's market realities.

The Traditional Regulatory Scheme

The Communications Act of 1934 empowers the FCC, among other things, to license radio frequencies to private entities for the provision of broadcast services to the public. It further provides, however, that the FCC may issue a license, or renew an existing license, only after determining such action will serve the public interest, convenience, and necessity.

This broad and elastic standard has been the basis for most government broadcast regulation. Over the years, the FCC has promulgated a host of rules in an effort to ensure that broadcast licensees operate in the public interest. Many regulations concern the business practices and technical aspects of a licensee's operations. Others, however, bear directly or indirectly on the content of the licensee's programming.

Although the FCC's deregulatory initiatives over the past decade have eliminated or relaxed some of these rules and reduced attendant administrative burdens, examination of programming remains a primary means by which the FCC determines which of several competing license applicants will best serve the public interest, or decides whether to renew an existing broadcast license.

Competition as a Better Guardian

Even beyond constitutional questions that have been raised, there is good reason to question to what extent continued content regulation of broadcasters is warranted, particularly given the continuing empowerment of the public to make choices, and a trend toward more personal freedom which promises to continue into the next century. Diverse program distributors increasingly offer services that cater to a broad spectrum of viewer and listener tastes. Many of the services envisioned by some as being preferable when the broadcast airwaves were denominated a "vast wasteland" are now available.

News, public affairs, health, music, nature, theatrical, and other programs that ranked high among regulatory priorities are available during much if not all of every broadcast day and this beneficial condition is expanding. Many of these programs are provided by cable networks which are not regulated. The viewer through a VCR can also "time shift", choosing to spend his or her limited time watching what they could not otherwise watch. In addition, the VCR affords viewers not only an almost limitless choice of movies, but also a rapidly increasing number of self-help and educational tapes.

The expansion in media outlets has increased and will continue to increase the amount of competition faced by broadcasters well into the next century. This will intensify the need for broadcast licensees to attract and retain viewers (and thus attract advertising revenues that cover costs and produce profits), by providing programming that satisfies the needs and interests of those viewers. An increasing number of competitors also diminishes the impact of any one player or group of players on the market over time.

The Radio Model

Circumstances in television seem ripe for a phenomena similar to that which occurred in radio. As the number of radio stations expanded, those which sought to be all things to all people often altered their approach. More narrowly-formatted radio stations, many of which developed local programming to achieve product differentiation, proliferated. Programming challenges are traditional in this sector. No sooner had commercial broadcasting emerged in the 1920s, but a former Commerce Secretary, for example, decried what he perceived as a trend toward excessive commercialization. Complaints that then-prevailing radio programming was insufficiently "uplifting" dominated Congressional floor debates when enactment of the 1934 Communications Act was under consideration. From its inception, therefore, broadcasting has proven a convenient target.

While criticism of certain programming should thus continue well into the next century, it is highly unlikely that viewer groups (other than perhaps the most esoteric) will somehow go unserved without government intervention. The economics of narrowcasting have changed, so that small groups' wants and needs will increasingly be satisfied. It is also reasonable to assume, based on experience, that broadcasters in a competitive marketplace will prove far better able than government to ascertain listener and viewer needs and wants, and then deliver programming which is responsive.

Avoiding Competitive Distortions

Perpetuating unfair and discriminatory content restrictions has undesirable consequences. The 1984 Cable Act, for example, eliminated most governmental regulation of the services provided by the cable systems. Videocassettes and VCRs are not subject to FCC regulation, nor has the FCC attempted to exercise regulatory authority over the expanding number of cable programming networks. MMDS licensees can avoid broadcast-type regulation by choosing to operate by subscription only. DBS providers will not be subject to broadcast regulation if they provide service on a subscription basis, as many will.

Continued content regulation of broadcasters alone may substantially impair their ability to compete against less regulated rivals. To the extent that governmental regulations create an environment where broadcasters feel a need to provide programming viewers do not want, or deter them from airing lawful programs viewers may desire, those regulations impose burdens upon broadcasters that will impede their ability to serve their viewers effectively. The growth of unregulated competition in media markets increases the undesirable competitive and societal consequences of such regulations applied to broadcasters alone.

Moving Closer to Free Press Parity

Importantly, content regulation of broadcasters may ultimately be held unconstitutional. In Red Lion Broadcasting v. FCC, the Supreme Court held that broadcast content regulation did not violate the First Amendment because broadcast frequencies were "scarce." It is difficult to show such scarcity today, however, when there are more than 10,000 broadcast stations operating within the United States and more than 71 percent of the nation's households receive at least nine over the air television signals.

The Supreme Court has signaled a willingness to reconsider the Red Lion scarcity rationale for broadcast content regulation. Other courts have expressed doubt whether the alleged scarcity of broadcast frequencies, even if true, can continue to justify treating broadcast licensees differently from other media (newspapers) for First Amendment purposes. Indeed, frequencies are presumably scarce for MMDS, DBS, and satellite program delivery, but those licensees are not subject to governmental content regulation. Moreover, as the FCC pointed out in its recent report on the so-called "fairness doctrine," newsprint was limited enough during World War II to require rationing, but government never conceived of using that fact alone as a predicate for imposing content regulation.

Nor is it necessarily true that there are more who wish to speak electronically than channels available. Obviously, there is an active market in broadcast and cable properties. Those wishing to broadcast can do so by buying a station, and many do so. Additionally, some cable systems offer public access channels, lease transmission capacity, and through specialized networks offer significant points of view, and are a means of electronic expression. There are a number of "video journals," which offer such vehicles. As channel capacity and distribution modes continue to expand, any shortage of electronic expression vehicles will decline.

Broadcasting is, and should remain, subject to existing criminal laws governing obscene, indecent, or profane programs, as well as civil libel liability. Federal Trade Commission and other regulations governing false or deceptive advertising should also apply.

There should be a shift in broadcast regulatory policy, however, regarding these particular limitations. The FCC should, of course, continue to ensure that broadcast licensees comply with U.S. laws. But as a matter of basic policy, it should rely in the future primarily on those agencies with expertise in a given area to delineate unlawful conduct and impose sanctions, if warranted. The public interest standard, in short, should not be employed to bootstrap the FCC and the broadcast licensing process into subject areas which are fundamentally the responsibility of other agencies.

Substantial further curtailing of government control of broadcast content could spark controversy. Some broadcasters fear ending content regulation, in part because compliance with regulations has provided considerable protection against renewal challenges. Some licensees may believe governmentally mandated programming requirements create a special status for broadcasters. Some in Congress and certain consumer groups, on the other hand, express concern that further elimination of content regulation will invite programming abuses. Some elected officials have suggested that according broadcasters more First Amendment parity with print media would negatively affect the political process.

Likely Public Gains

While these beliefs may be sincere, there is little hard evidence to suggest that removal of content regulation from the broadcast public interest standard will adversely affect the public. Indeed, what empirical evidence exists suggests the contrary. The so-called "fairness doctrine," for example, has not been in effect for more than one year. While there have been calls for its reinstitution, there has been no presentation of evidence pointing to societal harm. With an abundance of programmers and outlets, any evils sought to be remedied by such rules are far more likely to be addressed in the marketplace. As with newspapers, the traditional American antidote to unfair speech is not government regulation, but rather, more speech.

A Measured Transition

Given the concerns which have been identified, however, we recommend transitional steps to avoid even potential harms. First, the FCC should further deregulate radio broadcasting for a period of five years. Most observers agree the radio market is sufficiently competitive that further deregulation would not harm radio listeners and could, indeed, benefit industry and the public. In general, the more competitive a given communications business, the more significant any costs associated with needless regulation become. In radio, the commercial consequences of prevailing regulation have increased commensurate with rising, more intense regulation. Station sales prices in many instances are flat or declining today. There also are instances in which some stations are going off the air. If removing the cost burdens of needless regulation helps maintain but a few more radio choices than might otherwise prevail, the public will be that much better off. If a small rural radio station falters, and the service it provides its community is withdrawn, that should be because of a marketplace determination, and not the consequence of needless and costly regulation that persists long after it should have been withdrawn.

Further radio deregulation would allow policymakers to study the performance of a broadcast market operating free from governmental intervention. They could then determine whether abuses do occur. Such experience could be used in determining what degree of television deregulation -- or radio re-regulation -- would best promote the public interest.

Second, broadcasters should consider, and government should encourage, greater self-regulation by broadcasters as an alternative to governmental regulation. Industry-developed guidelines could be established governing such things as public service announcements, news, and public affairs programming. The government could facilitate this process by conferring any needed antitrust immunity in certain circumstances, for example, to deal with children's broadcasting issues.

Enlightened self-regulation by the broadcast industry would help convince skeptics that licensees can operate their stations fairly and responsibly without the heavy hand or raised eyebrows of the government. It works in other media industries and makes good business sense. Self-regulation could also help preserve the special status some broadcasters seek. In addition, there will remain those safeguards enforced by the Federal Trade Commission, Department of Justice, the Bureau of Alcohol, Tobacco, and Firearms, and other Federal and state agencies. These provide an ample "safety net" to prevent abuses, and can obviously be supplemented by Congress and the FCC, if necessary. There is no basis for assuming that any risks to the public's interests are so great, or that alternative remedies so ineffective, or any harms will materialize so quickly and irremediably, that perpetuating the current regulatory regime is warranted.

Reform of the Renewal Process

Elimination of rules governing content from the public interest standard will necessitate changes in the way the FCC renews broadcast licenses. Broadcasters and their investors will want continued stability and predictability in this process, and this is clearly in the public interest.

Under current law, existing licenses must be renewed periodically by the FCC. When a renewal application is filed, other parties have been allowed to submit competing applications for the same frequency. If competing applications are not withdrawn, the FCC must conduct a hearing to determine whether the public interest will be served by renewing the existing license or by awarding a license to a challenger. Typically, such hearings are lengthy and costly for all participants.

Although comparative renewals rarely result in loss of the incumbent's license, they can be very expensive to defend and have often been an invitation to abuse. Previous programming performance is frequently an incumbent's best weapon against a renewal challenge. As a result, incumbents might be more vulnerable to competing applications if, without further changes in existing renewal procedures, programming issues were eliminated from the FCC's public interest analysis. The FCC's license renewal procedures should, therefore, be modified if the broadcast public interest standard is purged of references to program content.

We believe procedures should be modified to create a substantial renewal expectancy for existing licensees. Once an applicant obtains a license and invests time and resources to turn that license into a business, he should be able to count on that license being renewed without having to fend off a competing applicant, absent some form of material failure. In addition, the degree of uncertainty attached to the expectancy of license renewal directly implicates the degree to which a licensee will be willing to invest new resources in a station and as such, can have a serious negative impact on the level of service provided to a community. In fact, few licenses are not renewed or otherwise taken away, which is as it should be. We would suggest that the law be changed to reflect this desirable reality.

In reviewing a particular renewal application, the FCC should consider, for example, whether or not the licensee has materially failed to comply with the Communications Act, applicable remaining FCC policies, and laws pertaining specifically to conduct as a broadcaster. It should also examine whether or not the grade of service provided (area covered, hours of operation) was materially deficient as compared to similarly situated and authorized stations in other communities. Unless the FCC can clearly demonstrate that these and other objective criteria have not been met, then the license should be renewed. With respect to less serious non-compliance, the FCC should utilize its power to impose administrative fines, rather than invoking the threat of the extreme sanction, that of license renewal denial, as an enforcement tool.

Too often the possibility of the ultimate sanction of license loss has been invoked to "persuade" licensees of the importance of following FCC directives. Such practices are particularly intrusive in the context of the FCC's role as potential regulator of the electronic press.

While this practice of invoking the possibility of license loss has been particularly present in the renewal process, it has not been confined to that setting. The current requirement imposed in the license transfer setting, that the

Commission must pass both on the qualifications of a seller as well as those of the purchaser of a station before a transaction will be approved, is troublesome.

If a seller has engaged in activities which violate of the Communications Act, that person should be allowed to transfer his or her license to a qualified applicant who will provide desired service to a community. Liability for fines potentially owed by such a seller could be attached to the proceeds of the sale.

Supporters of such a policy say it is important such a an errant licensee not be allowed to "profit" from misconduct. But the alternatives are to impose a possibly draconian punishment on licensees well beyond that commensurate to the misdeed, and to keep on the air during the pendency of the proceeding the very licensee whose conduct the Commission seeks to penalize. The more severe the potential sanction, the less frequently it will be applied, and the greater the likelihood it will be contested to the maximum possible extent. In short, fines and administrative sanctions -- not simply threats of license loss -- should be the primary enforcement tools relied upon by the FCC. The Commission already has authority to impose these penalties and to do so in a way that will protect the integrity of its processes.

Legislation, If Required

Broadcast renewal policies have evolved over the years and differ from those pursued by the FCC when the number of electronic media "voices" was far fewer. As the number of electronic media expands, and they become effective substitutes to broadcast service, the need meticulously to scrutinize each broadcaster's performance diminishes. What might have been appropriate in past days of broadcasting's predominance, in short, no longer is needed. Or, as the courts have stated, a regulatory regime perfectly appropriate under one set of market circumstances, can become inappropriate, even arbitrary and capricious, when those circumstances no longer exist.

The FCC enjoys broad latitude to tailor its regulation to accommodate market changes. The broad language of the Communications Act of 1934, as the Rostow Task Force observed, typically accords the FCC "near-constitutional flexibility." Many needed changes in broadcast renewal practice, therefore, are within the informed discretion of the FCC and, given a proper record, almost certainly would be sustained by a reviewing court. But even if the FCC determines that legislation nevertheless is necessary, it should address these points.

First, it should call for substantial curtailment in FCC broadcast content regulation, and, second, it should also propose changes in current license terms. Last revised in 1981, the Act now envisions maximum license terms of seven years for radio stations, and five years for television.

Differentiating between radio and television makes good sense. Initially, the FCC regulated television as if it were radio with pictures; until very recently, moreover, it essentially regulated radio as if it were television without pictures. And yet the commercial and competitive dynamics of these companion industries obviously differ greatly.

Radio licenses should be indeterminate, subject only to revocation on a proper showing, and television license terms should be extended to a maximum of ten years. Experience amply demonstrates that the 1981 changes, which altered the previous uniform three-year maximum, have significantly reduced administrative burdens for both industry and government, and had only positive effects on the overall level and quality of service to the public. Broadcast licensees should be able to devote their time and resources to competing in the marketplace and providing more services to their audiences, and not obliged to earmark resources to maintaining bureaucratic processes. Additionally, given current concerns over the Federal deficit, scarce government resources should be employed where the need is greatest, which is certainly not this area. The objective, in short, should be expanded service to the public -- not merely satisfying the paperwork and other requirements associated with an increasingly anachronistic regulatory system.

It is important that industry be accorded stronger incentives to invest in and improve broadcast service. Measures that discourage such actions in favor of pursuing other unregulated commercial alternatives should thus be reduced or removed. The United States has a substantial national investment in broadcasting. In addition to some $70 billion or more invested by the public in receivers, and $30 billion by industry in transmitters and associated equipment, radio spectrum resources of considerable value have been allocated to this important service. Broadcasting remains a highly cost-effective means of delivering high-quality video and audio services to the public. Our goal should be to maximize the efficiency with which these national assets are used to the ultimate benefit of the American people.

Conclusions

- Americans in the 21st Century likely will enjoy a dazzling array of electronic media and programming sources far exceeding that which is available today.
- Broadcast television may experience further structural changes, and may prove less profitable than at the present time, but there is no substantial reason to anticipate its economic demise.
- Radio, which has successfully weathered a number of fundamental commercial changes in its long history, should also continue to remain a strong sector.
- Cable television will become increasingly important as remaining cities are wired and as more and more households subscribe.
- Direct broadcast satellite and multichannel multipoint distribution systems will supplement existing video services in some areas.
- Increasing levels of broadband capacity, generally through fiber optic systems in the local telephone and cable networks, may make possible the commercial provisioning of a "video dial tone" which could give subscribers

access on demand to a virtually unlimited library of video, audio and data services.

- Such a "video dial tone" could contribute to the formation of an electronic "national neighborhood" that through shared experiences and intercommunications, helps bring the American people and our communities closer together.

- The "scarcity" of broadcast frequencies, which formed the rationale for extensive broadcast content and other regulation, no longer exists.

- The content-based portions of FCC rules now apply to a rapidly decreasing amount of the video and audio programming received by the public. They apply to television and radio broadcasters, not to competing media, threaten to deter investment, distort market performance and development, and may also be unconstitutional.

Recommendations

- Congress and the FCC should immediately take steps to remove most remaining content-based rules governing radio broadcasting and modify licensing procedures in order to gain experience to determine what degree of television deregulation could best promote the public interest. If legislation is deemed necessary, it should seek to foster maximum competition by, among other things, providing for indeterminate radio licenses, and ten-year licenses for television.

- The broadcast industry should, in the meantime, develop self-regulation as have other media industries.

9

International and Domestic Policymaking in the Year 2000

Spurred by competition, less fettered by unnecessary regulatory burdens, and encouraged by Government, science and industry can create, develop, and distribute a wealth of telecommunications and information devices, processes, and networks that will dramatically enrich our society by the year 2000. The timing, extent, and cost of these enrichments will depend not only on creative and productive efforts, however, but also on the wisdom and forbearance of government policymakers and regulators, both in the United States and throughout the world. How key government decisionmakers treat -- or permit others to treat -- these technological advances, and whether they view the enormous changes that these developments portend as a welcome advance or a fundamental threat, can be expected to have a substantial impact upon the introduction of new services and technologies.

Regulators and policymakers in the United States have generally supported, or at least condoned, the technological and competitive advances driving our telecommunications and information policies, although at times with some hesitation and confusion. Some other countries are now also allowing some competition. Yet much of the rest of the world has not been nearly as supportive and has, in fact, constrained and even prohibited the introduction of new services and means of offering those services. In an era of global markets, a crucial challenge we face in international venues will be persuading other governments to liberalize access to their networks and markets, and to authorize the provision of new services, while maintaining a strong consensus in favor of marketplace solutions at home.

Overview of Current Arrangements

How the Government organizes itself to oversee the international and domestic telecommunications and information sectors toward the year 2000 is the chief focus of this chapter. Since the dawn of modern telecommunications, when radio and wireline communications were first introduced, concern over issues such as ownership, access, universality, control, and spectrum interference have driven the organization and reorganization of U.S. regulatory and policy structures. Over the decades, as telecommunications has assumed an ever more prominent role in our economy and lives, the evolution of appropriate regulatory and policy structures has also become more essential, complicated, and perennially controversial.

Capitalizing on Opportunities and Protecting the Public

Although during the preceding half century, telecomunications and information technology, and associated businesses, have developed beyond the dreams of even the industry itself, the governmental regulatory mechanisms and means of developing telecommunications policy remain relatively unchanged from those adopted more than half a century ago. The chief focus of the Communications Act of 1934 was on the regulation of telecommunications, not necessarily its maximum development and promotion. The statute did direct the FCC to promote the larger and more effective use of radio, for example, and encouraged close oversight of telephone technology, to ensure that advances potentially beneficial to the country would be deployed. In general, however, the drafters of that legislation saw the talents and resources of industry presenting more of a challenge to the public interest than an opportunity for national progress.

One of the principal concerns dealt with here is the appropriateness of continuing the existing statutory model into the 21st Century. Another issue is how best to resolve the tension between our desire domestically to minimize Government's role while recognizing, as earlier discussed, that attenuation of Government involvement in an international context may have the practical effect, not of promoting market solutions, but rather aggrandizing the power of foreign, government-owned or controlled, communications monopolies.

Domestic and International Policy Paradigm

The trend domestically has plainly been toward a less interventionist, deregulatory role for Government, as previously discussed in this report. This approach, moreover, has clearly been justified and has yielded substantial public gains. But in the international arena, faced with foreign government-owned or controlled monopolies, restrictive practices, contentious battles over standards, and other controversies, an effective and active Federal Government role is required.

How Government Policymakers Now Do Business

On numerous occasions, private industry, academicians, members of Congress, and Executive branch policymakers have examined the ability of the U.S. Government to establish and achieve long-term telecommunications and information policy goals, particularly in the international arena. As these industry sectors become increasingly pivotal to our society and economy, such issues should gain greater visibility. Government policies are only one of the numerous factors affecting communications, but those policies, and how they are developed and implemented, plainly can have decisive effects.

Too Short-Term and Reactive a Focus

By most estimations, the current organizational structure exhibits three fundamental defects: First, its outlook often tends to be reactive and skewed toward achieving short-term objectives rather than proactively establishing and working to reach long-range goals. The current policymaking apparatus can often focus too much on maintaining the status quo, despite the influx of technological innovation and marketplace pressures. Rather than managing change to accomplish broad-based public interest goals, policymakers too often become preoccupied with arbitrating between narrow, turf-minded interests. A dynamic sector affected significantly by what government does or does not do needs a government that can act thoughtfully and at times relatively quickly.

In particular, there is a critical need for long-range policy planning, as opposed to the ad hoc response to a current crisis which has characterized many U.S. regulatory approaches. Examples of this ad hoc, reactive approach date back to the earliest days of telecommunications policymaking. The first international radio conference was held in 1903 to overcome the refusal of the Marconi Company to receive messages sent over non-Marconi equipment. The first major Federal domestic telecommunications legislation, the Mann-Elkins Act, was passed in 1910, and placed interstate and foreign telephone and telegraph services under the regulatory jurisdiction of the Interstate Commerce Commission. It was largely a response to AT&T's acquisition of an interstate telephone service monopoly and the ensuing clamor for some kind of Federal regulation.

The need for quick responsive decisionmaking will remain with us, but proactive, long-range policymaking requires an ongoing creative approach to fundamental issues as well as immediate crises. Problems and issues necessarily overlap and interrelate. Yet policy has too often been formulated primarily as part of a discrete Government response to an existing crisis. This reflects the view that telecommunications has been a mission-support function, rather than a critical economic and social infrastructure item similar to post roads, navigable waterways, railroads, and interstate highways. While we may have been able to get away with this short-sighted approach in a simpler paper and voice communications-based past, we cannot afford this approach in the information age.

Dispersed Resources

Second, the allocation of financial and staff resources among a variety of particular agencies, most with only limited interests or responsibilities in communications and information policies, does not foster the development of effective communications policy or policymakers. As a result, experts in relatively narrow areas, or in broad areas with only a narrow communications interest, often fail to see the broader interplay of interdependent communications and information concerns. Not unexpectedly, this has produced a patchwork of roles and structures, rather than a coherent governmental framework for formulating and implementing national telecommunications policies and goals. And while the "cross-pollination" of expertise might fail to occur, forum shopping by interested parties does not.

Absence of Focused Responsibility

Finally, the current structure makes leadership -- and effective Congressional oversight -- difficult. So long as ultimate responsibility for most communications and information policy is fragmented among a multitude of agencies, and between domestic and international policymaking, then short-term, makeshift solutions will too often emerge as a hastily-coordinated, lowest common denominator.

To some extent, some of this dispersion of real or perceived authority may be unavoidable. The structure of the Executive branch tends to mirror Congressional committee arrangements. As committee jurisdictions overlap, so too do those of Executive agencies, in telecommunications as in other areas. And, as telecommunications and information services become more important factors in other fields -- trade and financial services, for instance -- the number of potential participants in the telecommunications and information policymaking will likely expand.

Circumstances in the U.S. Government are only slightly more confused and confusing than abroad. Squabbles among varying parts of the Japanese, British, West German, and other governments over telecommunications and information issues are hardly uncommon. In the United States however, our greater diversity, combined with the absence in too many instances of a final determiner of our telecommunication and information policies, has made effective international implementation difficult.

A Vulnerability Assessment

In the final analysis the problem is that for most issues there is, at times, no one in charge, and the buck does not stop anywhere. Our democratic republic embodies a variety of checks and balances, and separation of power concepts not typically present in parliamentary democracies. Disputes within the U.S. Government tend, therefore, to be harder to resolve. While not without advantages, the resulting diffusion of power tends to favor the status quo and inure to the benefit of incumbents. And, in an international context, this situation tends to benefit our trade rivals, some of whom demonstrably have mastered the ability to energize one part of the American Government against another.

Working Toward a Solution

The problem thus is not merely the need for better coordination, but the need for coordinated decisionmaking. Telecommunications has become a very high stakes sector with increasingly interdependent issues which require a highly integrated approach to adequately address policy issues. A lead policy agency must be proactive and not merely reactive. It must have a cross-disciplinary depth of skills encompassing economics, engineering, political science, and communications and intellectual property law, with both domestic and international dimensions. It must also be able to command sufficient acceptance within Government as well as the private sector in order to limit vulnerability to deliberate manipulation by foreign parties and interest groups.

A More Holistic Approach

By bringing these varied disciplines and perspectives together in a holistic approach, a lead telecommunications agency could achieve a synergy such that the whole will be greater than the sum of its parts. For example, if the issue is future directions for Direct Broadcast Satellite (DBS) services, a comprehensive policy -- and hence the agency developing the policy -- must consider such interrelated issues as the advent of high-definition television (HDTV), spectrum needs and orbital locations, the Space World Administrative Radio Conference, Regional Administrative Radio Conferences, demands by the developing world for a "New World Information Order," transborder data flows, commercial space policies, copyright protection, scrambling, broadcast policies premised on localism, antitrust, and even local zoning regulations. To ignore any of these issues may result in the development of flawed policy positions which undermine our goals in international forums.

Current Agency Responsibilities

More than two dozen agencies of the Federal Government, as well as many committees and subcommittees of the U.S. Congress, are involved in the development, implementation, and operation of U.S. telecommunications and information policy. For some agencies, telecommunications and information policy is a primary mission; for others an occasional sidelight. But each has different expertise, tools, and available forums in which to advance its goals. Each brings a different perspective, if not constituency, to an issue.

Within the Federal Government, power and oversight responsibility is shared by a host of agencies, some of which are concerned exclusively with domestic issues, some with international matters, and some with a combination of the two. There is a further split of authority and responsibility between those Federal Government agencies within the Executive branch, (e.g., Departments of Commerce and State) and the Federal Communications Commission (FCC), an independent regulatory agency created by Congress. Additionally, the U.S. Government has policymaking agencies (e.g., FCC and Department of Commerce) and agencies predominantly involved as telecommunications users (e.g., Department of Defense).

In addition, in the domestic arena there is a split in authority between Federal and state policymakers and regulators. The latter are comprised primarily of state legislatures and public utility commissions whose area of responsibility is focused upon intrastate common carrier and private carrier issues. In order to avoid or reconcile conflicts between the Federal and state regimes in many instances, the Federal Communications Commission has established Joint Boards, made up of federal and state regulators, which make recommendations on such issues as the split of telephone revenues between the local and long distance portions of the network and the level of subscriber access fees.

Key Federal Agencies

Among the major participants in the oversight of the telecommunications and information sectors are the National Telecommunications and Information Administration of the Department of Commerce (NTIA), the Bureau of International Communications and Information Policy of the Department of State, and the Federal Communications Commission (FCC). The role of each is discussed briefly below. Also described are the Senior Interagency Group on International Communications and Information Policy, which was established by the National Security Council, the Economic Policy Council, and, briefly, a few of the other more prominent Federal Government agencies responsible, to varying degrees, for communications and information policies.

Department of Commerce -- National Telecommunications and Information Administration (NTIA). The primary mission of the Department of Commerce is "to foster, promote, and develop the foreign and domestic commerce of the United States." Since 1913, this mission has encompassed the responsibility to foster, serve, and promote the nation's economic development and technological advancement.

The Department's telecommunications policymaking functions are centered in the National Telecommunications and Information Administration (NTIA), which was created pursuant to Reorganization Plan No. 1 of 1977, with the responsibilities of the Secretary of Commerce under Executive Order 12046 delegated to it. That 1978 Executive Order abolished the Office of Telecommunications Policy (OTP) in the Executive Office of the President, and transferred most of its functions to the Department of Commerce. NTIA also absorbed the functions of the Office of Telecommunications (OT), which had operated within the Department of Commerce.

As head of the successor agency to both OTP and OT, the Assistant

Secretary for Communications and Information, who also serves as Administrator of NTIA, inherited a broad charter which established NTIA as the central telecommunications policymaking authority and spokesman within the Executive branch. In addition, NTIA manages the Federal Government's use of the radio frequency spectrum and, through its Public Telecommunications Facilities Program, awards grants to noncommercial entities to help them acquire telecommunications equipment. NTIA's Institute for Telecommunication Sciences constitutes the Government's principal independent telecommunications and radio frequency research asset.

NTIA's telecommunications policymaking responsibilities require it, among other things, to:

1. serve as the President's principal adviser on telecommunications policies;
2. develop and set forth, in coordination with the Secretary of State and other interested agencies, plans, policies, and programs which relate to international telecommunications issues, conferences, and negotiations, and coordinate economic, technical, operational, and related preparations for United States participation in international telecommunications conferences and negotiations;
3. provide for the coordination of telecommunications activities of the Executive branch;
4. assign frequencies to radio stations belonging to and operated by the United States;
5. develop telecommunications policies pertaining to the nation's economic and technological advancement and to the regulation of the telecommunications industry;
6. ensure that Executive branch views on telecommunications matters are effectively presented to the Federal Communications Commission and, in coordination with the Director of the Office of Management and Budget, to Congress;
7. conduct studies and make recommendations concerning the impact of the convergence of computer and communications technology.

Functions relating to international communications satellite systems, vested in the President by the Communications Satellite Act of 1962, and the INMARSAT Act of 1978 have also been delegated to NTIA.

The Assistant Secretary has served as the President's principal telecommunications policy adviser since 1978, but concern has been expressed about NTIA's lack of authority to implement the policies it proposes, as well as its ability to deal effectively with other agencies, such as the Department of State on telecommunications issues which have an impact foreign relations, and with the U.S. Trade Representative (USTR) on telecommunications issues which affect foreign trade matters.

The former problem results, in part, from the division of authority between the Executive branch and the FCC. As a general matter, NTIA, in coordination with other Executive branch agencies as necessary, will formulate a telecommunications policy position. That proposal will then be submitted to the FCC for its consideration, possible adoption, and ultimate implementation. Unfortunately, this arrangement vests the final authority for the implementation of U.S. policies in an entity that is not directly responsible to the President, although indirect relationships exist through designation of the Chairman, renominating authority, and the like. Where the issue involves international matters, there is thus a potential that the final arbiter may act inconsistent with, for example, the President's foreign or trade policy agenda.

As for the delineation of authority among the Executive branch agencies, rather than clearly delineating telecommunications policymaking responsibilities and authority, Executive Order 12046, Congressional authorization and appropriations measures, and underlying statutes in many instances do not clearly establish the respective responsibilities of NTIA, the Department of State, USTR, the Office of Management and Budget, the Department of Justice, the Department of Defense, and other agencies. Despite Executive Order 12046's mandate to NTIA to "ensure that the Executive branch views ... are effectively presented," on any given issue, one or more of these other agencies may take a position before the FCC, the courts or other fora, and there is no established coordination mechanism.

If different agencies were to make different recommendations to the FCC, one result is that an independent regulatory agency arbitrates among Executive branch agencies. The absence of consistent or regularized coordination when the Justice Department takes positions in court on appellate and other matters also heightens the potential for an actual or perceived split in Executive branch communications policies. Congress's oversight responsibilities, moreover, are often effectively undermined, because any one agency has a plausible explanation for policy shortfalls.

Department of State. The Secretary of State serves as principal foreign policy adviser to the President, and is responsible for the overall direction, coordination, and supervision of U.S. foreign relations. The State Department's role in the conduct of international telecommunications and information policy has traditionally been treated as a subset of that function. An assumption in the past has been, in other words, that State provides the foreign policy element in telecommunications policymaking and, when those policies are to be advanced overseas, assists in advocating them; but the policy decisions and final judgment calls, at least in theory, are the province of other agencies.

Executive Order 12046 in 1978 appeared to reaffirm this view of the State Department as a participant, not policy decisionmaker, in its grants of authority to the Secretary of State:

> *With respect to telecommunications, the Secretary of State shall exercise primary authority for the conduct of foreign policy, including the determination of United States positions and the conduct of*

> *United States participation in negotiations with foreign governments and international bodies. In exercising this responsibility the Secretary of State shall coordinate with other agencies as appropriate, and in particular, shall give full consideration to the Federal Communications Commission's regulatory and policy responsibility in this area.*
>
> *[The Secretary of State shall] be responsible, although the Secretary of Commerce is the chief point of liaison, for instructing the Communications Satellite Corporation.*

Executive Order 12046 reaffirmed this view by its mandate to the Secretary of Commerce as well:

> *The Secretary [of Commerce] shall provide advice and assistance to the Secretary of State on international telecommunications policies to strengthen the position and serve the best interests of the United States, in support of the Secretary of State's responsibility for the conduct of foreign affairs.*

The Under Secretary of State for Security Assistance, Science, and Technology has lead responsibility within the State Department for developing its views on U.S. international communications policy and ensuring collaboration with other interested agencies. Under his purview is the Bureau of International Communications and Information Policy (CIP). At the same time, however, principal responsibility within the State Department for telecommunications trade and transborder data flow problems lies with the Bureau of Economic and Business Affairs, which reports to the Under Secretary for Economic Affairs. Matters concerning international organizations are handled by the Under Secretary for Political Affairs.

Federal Communications Commission. The FCC was created by the Communications Act of 1934 as an independent regulatory agency responsible directly to the Congress. Although its five Commissioners are appointed by the President, once confirmed by the Senate for five-year terms, they do not serve at the pleasure of the President. The Chairman is designated by the President, but the agency is not bound by the Administration's policies.

The FCC carries out some of its responsibilities for telecommunications through oversight of carrier investments, rates, and services. The Commission reviews applications for the construction and operation of communications facilities, service offerings, and the rates charged. It regulates broadcasting and assigns frequencies to non-Federal Government users. It participates in international negotiations and conferences. The FCC also establishes rules and regulations for international telecommunications, engages in international facilities planning and coordination, and can significantly influence U.S. policy and the reactions of foreign entities. The Communications Satellite Act of 1962 and INMARSAT Act of 1978 give the FCC regulatory responsibilities over the common carrier activities of Comsat as well.

As currently structured, the Executive branch makes recommendations to the FCC concerning U.S. regulatory policies. The Commission is responsible for making final determinations in almost all cases, giving whatever weight it chooses to the Executive's point of view. Once it has decided upon a particular policy course, the FCC is also the implementing agency.

This has led to the suggestion that the policy determination authority should be separated from the implementation authority, with the former responsibility delegated to the Executive branch, especially for international telecommunications policy (as discussed below).

Even under the current structure, however, the FCC's direct supervisory powers over the overall communications industry has steadily diminished. This is perhaps the inevitable by-product of extensive deregulation in both the mass media and common carrier arenas, and the decision not to regulate the information industries under the FCC's Computer Inquiry decisions. As earlier discussed, moreover, this decoupling of regulation and the communications and information market results from the fact that the unregulated parts of the overall market are growing faster than its traditional, regulated core, and almost certainly will continue to do so.

The Commission is thus increasingly not involved in some of the most economically significant communications and information markets. This further supports the conclusion of some that the primary governmental entity with overall responsibility for communications and information policy issues should not be an independent agency with a regulatory perspective and grant of authority.

Other Agencies. In addition to NTIA, the State Department, and the FCC, more than two dozen Federal agencies are involved in the creation of telecommunications and information policy. The most active include:

o Department of Justice (statutory respondent for the U.S. Government in court appeals from FCC actions, as well as counsel for the Federal Government in litigation. This has included ongoing enforcement of antitrust consent decrees, e.g., the AT&T and television network decree;

o U.S. Trade Representative (primary responsibility for developing and for coordinating the implementation of U.S. international trade policy);

o Department of Defense (including the constituent agencies: Army, Navy, and Air Force, and the related but separate Defense Communications Agency, National Security Agency, and other agencies. Defense is responsible for national security and constitutes the world's largest telecommunications services and facilities user community);

o Copyright Office (intellectual property);

o General Services Administration (Federal Government telecommunications services and equipment procurement);

o Department of Agriculture (Rural Electrification Administration's

Telephone Program).

Interagency Coordination Mechanisms

Several means exist which, in theory, can ensure the coordination of certain U.S. communications policies. These are discussed below.

The Senior Interagency Group on International Communication and Information Policy

The Senior Interagency Group on International Communications and Information Policy (SIG) was created by the National Security Council in 1984. It is one of several dozen SIGs established to address particular issues and policy areas. This SIG includes 16 agencies and is co-chaired by the head of NTIA and the Under Secretary of State for Security Assistance, Science, and Technology. It meets as issues arise in an effort to examine proposed international telecommunications and information policy alternatives from a full range of perspectives.

The Economic Policy Council

Another body which has played a policy coordinating role is the Economic Policy Council (EPC), a Cabinet-level body established by President Reagan in 1985 to resolve interagency economic policy issues, which have included significant telecommunications and information policy issues. The EPC is composed of the Secretaries of Treasury, Commerce, State, Energy, Agriculture, Labor, the Director of the Office of Management and Budget, the U.S. Trade Representative, and the Chairman of the Council of Economic Advisers. The Vice President and the Chief of Staff serve as ex officio members, and the heads of nonmember departments and agencies are invited to participate in deliberations whenever matters affecting their organizations are on the agenda.

Problems in Telecommunications Policymaking

The previous sections provide an overview of the diversity of interests and responsibilities of telecommunications and information policymakers in the Federal Government. While diversity and cross-fertilization often yield strength, a review of the history of U.S. telecommunications policymaking demonstrates that they can also result in confusion, jurisdictional disputes, uncoordinated efforts, and inadequate preparation. These weaknesses are not new.

During its 1946 investigation of international communications problems, the

Senate Committee on Interstate Commerce stated in its report that, "During the course of the hearings it became obvious that the affected Government departments were not of one mind with respect to the policy that should be laid down by this Government to govern American international communications. . . . The Executive had constituted an interdepartmental committee to study the problem and make recommendations . . . .(but) this interdepartmental committee had failed to reach complete agreement . . . . The committee regards with favorable anticipation the recent creation of another interdepartmental committee and trusts that this agency will be able to shortly recommend to the President a unified department view."

The Truman Recommendations

In 1951, President Truman's Communications Policy Board considered, among other questions, how the U.S. Government could "strengthen its organization to cope" with the major domestic and international telecommunications issues facing the nation:

> *Problems such as these cannot adequately be considered on a piecemeal basis. They must be viewed as parts of the broader problem of developing a total national communications policy, designed to assure the most effective utilization of the various forms of communications facilities, and the full satisfaction of those needs which are most essential to the broad public interest. An overall, objective review of this entire situation is urgently needed.*

The Board's report centered around questions which require reassessment today as well, including:

(1) How shall the United States develop a national policy and position for dealing with other nations in seeking international telecommunications agreements?

(2) How shall the United States develop policies and plans to foster the soundness and vigor of its telecommunications industry in the face of new technological developments?

(3) How shall the United States Government strengthen its organization to cope with the issues stated above?

In criticism which would be echoed throughout the ensuing four decades the Board stated that:

> *In our efforts to discover the current state of Government telecommunications policy as preliminary to recommending needed steps toward a total national communications policy, we once more encountered dispersion, confusion, gaps, and deficiencies in the*

> *product and performance of those agencies charged with telecommunications policy responsibilities.*

The Board's final report contained several findings concerning Government organization including.

> *(1) Fundamental changes in telecommunications require the overhaul of government machinery for formulating telecommunications policy and for administering certain telecommunications activities in the national interest.*
>
> *(2) The whole Government telecommunications structure is an uncoordinated one and will be even less adequate in the future than it has been in the past to meet the evergrowing complexities of telecommunications. A new agency is needed to give coherence to the structure.*

During the ensuing four decades there were numerous commissions, studies, reports and proposed restructurings of the Executive branch policymaking machinery. Remarkably, despite the studies, decisions, and revisions, the fundamental criticisms remain the same.

The Rostow Recommendations and Implementation

In 1968, the Rostow Task Force produced an entensive report covering both domestic and international communications issues. Its findings were remarkably similar to those of previous groups charged with such responsibilities. The Task Force stated that:

> *Traditionally, government has viewed telecommunications primarily as a mission-support function, rather than a focus for public policy. The result has been that policy has evolved as a patchwork of limited, largely ad hoc responses to specific issues, rather than a cohesive framework for planning. Government organization for this formulation and implementation of communications policies reflects this evolution. . . . The patchwork nature of the present structure is not conducive to optimum performance of the telecommunications activities and requirements of the Federal Government.*

The Rostow Task Force recommended that a new Executive branch entity provide long-range planning and policy formulation, as well as coordinate spectrum use. That contributed to the creation of the Office of Telecommunications Policy in the Executive Office of the President.

The Office of Telecommunications Policy, which remained intact for almost eight years, centralized a great deal of authority within the Executive branch, actively sought out and coordinated agency views, and presented the Executive branch's views. In 1977, however, plans were made to reduce the size of the Executive Office of the President and reassign selected functions to other entities.

The 1977-78 Reorganization

As detailed elsewhere in this report, the domestic and international communications marketplace during 1977-78 -- and the implications of reorganization -- were significantly different. Federal policy then sanctioned only limited domestic communications market competition. The United States also had a substantial positive communications trade balance, and U.S. technological and commercial leadership was assumed to be secure.

Reorganization Plan No. 1 of 1977 abolished the Office of Telecommunications Policy and created the position of Assistant Secretary of Commerce for Communications and Information, centralizing many telecommunications responsibilities in that office. This effort resulted in creation of NTIA, as discussed earlier, but avoided facing the difficult organizational and decisionmaking questions we continue to confront today. To speed the process of reorganization and minimize problems for an incoming Administration, the restructuring was implemented with the many overlapping grants of authority of Executive Order 12046.

In a 1980 Report, a House Subcommittee was highly critical of this confusing mandate:

> *While State and Commerce are carefully parceling out their responsibilities, the private sector is understandably confused about where to go to ensure effective contributions to policy development and to get help for particular problems.*

The Subcommittee's conclusion was well supported by private industry testimony. For example, the Association of Data Processing Service Organizations (ADAPSO) had written:

> *The United States enters discussions, debates and participates in other fora involving international computer services with no real coordinated national policy and with many disjointed representations. As a result, independent American firms do not have the support of a unified national policy when they negotiate with foreign governments or PTTs . . . .*

Ensuing Problems

Rather than a panacea, this latest reorganization effort failed to establish a dynamic policymaking focal point with clear decisionmaking authority. As earlier discussed, reorganization fragmented powers and dispersed responsibilities among many agencies. It also inserted several part-time telecommunications and information policymakers into the process, their lack of background and institutional expertise in either telecommunications or information policy notwithstanding. A consequence was a tendency for parties to weigh in on isolated issues and immediate dilemmas from a particular perspective, often unaware of the potentially profound ramifications of their recommendations on broader telecommunications concerns.

In the ensuing years, little has been done to reconcile the delegations of authority contained in the 1978 Executive Order with the potentially conflicting grants of authority found in other measures. This blurring of responsibilities may have affected overall Executive branch communications and information policymaking even by those with the clearest powers and responsibilities. When a senior policymaker has a number of responsibilities, a natural inclination will be to devote greatest attention to those where his authority is clearest. That focus will have profound effects on planning, budgeting, and constancy. It will also sometimes result in staff frustration and in more decisions being made at the staff level.

Clarifying Responsibilities

Despite almost universal agreement that problems remain in the structure of Government telecommunications policymaking, a viable solution remains elusive. The Computer and Business Equipment Manufacturers Association (CBEMA) recognized this in its comments submitted in response to a Notice of Inquiry conducted by NTIA in 1982:

> *The Executive branch of the U.S. Government, as currently structured, is designed to deal with well bounded problems and policies . . . . However, it is ill-equipped to deal with problems and policies which cut across the boundaries of those areas of the agencies chartered to deal with them. The existing executive agencies lack the charter or experiential background necessary to deal with issues of the contemporary technology involving international channels for information, the information that flow in those channels, and the processes which might occur during transit.*

Realizing that these fundamental organizational problems have existed and eluded solution for so long, however, should not diminish efforts now to deal with them. Telecommunications and information have become increasingly vital components of our economy and national life. As they grow in importance and affect more and more of our economy, these industries attract more intense and widespread interest. Yet we have clearly reached the point where the continued inability of our Government to get its own telecommunications policy "house" in order could seriously threaten to a significant degree the ongoing efficient development of these key high-technology, "sunrise" industries and, therefore, the benefits which these technologies can deliver.

The Cost of Delay

This nation can no longer afford to have its Government as part of the communications policymaking problem. For example, it took the Executive branch agencies involved some 18 months to develop and put before the President a proposed new policy with respect to international satellite systems separate from INTELSAT -- despite the fact there was fundamental agreement from the outset among all involved as to basic policy directions.

In an era of intense competition across global markets and rapidly developing technologies, we can ill-afford to hobble U.S. industry with the costs inherent in such delays. By perpetuating such institutional diversity, we will continue to afford interest groups, including foreign-based interests, an environment conducive to deliberate outside manipulation. The ability of Congress, through considered oversight, to ensure effective implementation of national policies and laws also is at risk under current arrangements.

Need for Action

Government reorganization is highly desirable if we are fully to exploit telecommunications technologies and capitalize on their economic and societal potential. The problems of coordination and policy leadership are particularly acute in international telecommunications.

As earlier discussed, this is due to the fact that U.S. firms typically cannot act unilaterally, but must act in concert with one or more foreign partners. In most other countries this means a government-owned or controlled entity. Competition is often frustrated by countervailing government intervention abroad. Dealing with this intervention becomes very difficult, if not impossible, when the U.S. Government's policy process is disordered.

In view of the fragmented telecommunications policymaking structure of the Executive branch, both between and occasionally even within agencies, it is not surprising that private industry is often confused as well. Private sector representatives in meetings during development of this report cited the fragmented, ambiguous grants of authority, and consequent problems. Many also called for an arbiter of U.S. telecommunications and information policy, short of raising each issue to the attention of the President.

Executive Branch Policymaking:
A Blueprint for the Information Age

To resolve these difficulties, any fully effective telecommunications and information policy entity must have sufficient expertise and authority. So equipped, it could then serve as a focal point for private sector interaction, government coordination, and foreign negotiations. In recognition of their vital importance to the nation, many in private industry maintain that telecommunications and information policy decisions also require high-level attention in the Executive branch. Because international telecommunications and information policies cannot be divorced from domestic issues in an era of global markets, moreover, any fully effective policymaking entity should have expertise in both fields.

Focused Leadership

The problems caused by inadequate coordination were succinctly expressed in 1982, again by the Computer and Business Equipment Manufacturers Association, when it stated that:

> *until such time as there is a central authority in the United States vested with the responsibility of coordinating and articulating overall international communications and information policy, negotiating international rules with our trading partners, and participating in the development of appropriate means by which those rules will be enforced, the U.S. will continue to be at a disadvantage.*

The Secretaries of Commerce and State and U.S. Trade Representative are legally required to coordinate their efforts with other agencies, but there is no specified mechanisms to ensure that this will occur. Unfortunately, accomplishing such coordination is difficult when faced with disputes among agencies, competing demands for high-level attention, time pressures, and often inadequate resources.

Consolidating Authority

Although there have been countless efforts to improve coordination among the various Government agencies responsible for fashioning telecommunications and information policy, they have failed and are likely to continue to fail because they do not address the underlying cause of the problem. In the final analysis what is lacking is not coordination, but the opportunity for leadership necessary to develop a clear Executive branch policy position which ultimately, in its original or adjusted form, represents the agreed view of the Administration. To achieve this requires not only an entity which seeks and coordinates various agency views, but one with sufficient authority to arbitrate divergent positions and ultimately establish the Executive branch's policy, a policy which other agencies support and follow.

In 1983, then-Secretary of Commerce Malcolm Baldrige described for a Congressional hearing the diffusion of telecommunications policymaking responsibility among Executive branch agencies and the major impact this was having on our ability to compete internationally. He focused on the multiple overlapping grants of authority in Executive Order 12046, noting that:

> *Executive orders also have to accommodate competing interests, of course, so words like 'coordination,' those standard bureaucratic terms, get used that mean all things to all people, depending on what part of the Government you are in. We try to work cooperatively with the other agencies, but government by committee simply is not a very strong way to go about things.*

He then went on to tell the committee:

> *I think one of the options we should consider is revising the Executive Order*

to indicate who exactly is the final authority on international telecommunications and information issues.

NTIA's 1983 Recommendations

The guiding principles in establishing such authority were set forth in NTIA's statutorily required study of international telecommunications which was submitted to Congress in 1983:

(1) the authority must be centralized in a single place;

(2) the coordinating entity, agency or person must have a clear and strong grant of authority and responsibility for coordinating telecommunications and information policy;

(3) the entity, agency or person must have the power to mediate differences among agencies and make final decisions;

(4) the entity should establish a formalized interagency policy advisory body, supported by a secretariat, and which meets regularly to assist in the formulation and implementation of policy; and,

(5) there should be a clear and regular structure for industry input.

Furthermore, this authority should represent the United States at all international telecommunications and information conferences, and should be clearly established as the President's principal adviser and spokesperson on telecommunications and information policy.

Assigning Responsibility

Once the necessity for establishing a final decisionmaking authority is recognized, the question is where in the Executive branch such authority should reside. Under the current delegations of power, likely candidates include the Departments of State and Commerce. Other possible arrangements include creating a new Special Adviser to the President, an Office within the Executive Office of the President, or a reconstituted OTP. Even the establishment of a Department of Communications has at times been suggested.

Clear Signals

Where a government places authority over a particular area of commerce signals, first, what it thinks are the most critical aspects of that area; and, second, dictates how other countries will react. If, for example, the lead agency for establishing U.S. communications and information policy were to be the State

Department, it is likely foreign governments will think that the United States views these policies primarily as a means of projecting political power. In turn, these other nations will be inclined to respond by sending their own foreign ministry personnel to international negotiations and conferences.

We properly treat the telecommunications and information industries as essential parts of our commercial infrastructure, both in and of themselves and as prime components of most other industries. U.S. policies that govern these industries are therefore developed primarily for sound economic reasons. We should avoid projecting the appearance that the United States views telecommunications and information policy primarily as an instrumentality of political power. The lead agency responsible for developing communications and information policies, and for presenting those views to foreign communications entities and ministries, should thus have broad commercial expertise.

One obvious choice for final decisionmaking authority would be the Secretary of Commerce, because the Department of Commerce has a natural commercial orientation and, through NTIA, already serves as the principal Executive branch agency responsible for both domestic and international communications and information policy. This choice would accurately reflect the trend toward globalization of the communications industry documented elsewhere in this report, and the difficulty of separating domestic policies from their international implications, and vice versa. In its present incarnation, NTIA also has staff expertise in the pertinent areas of telecommunications and information policy, law, technology, and economics. Additionally, the Department of Commerce has, as part of its United States and Foreign Commercial Service, commercial attaches stationed around the world, thereby greatly expanding existing in-house foreign contacts and providing the Department with daily access to foreign telecommunications authorities.

Arguably, in order to provide the broadest perspective and to elevate its stature within the Executive branch, NTIA might be reconstituted at the Under Secretary level. Again, some have even suggested that it be established as a separate Department. This would adequately reflect the prominence of the telecommunications and information sector within our economy, on a par with transportation, labor, and capital, and would be consistent with the purpose and tradition of spinning off or establishing Executive branch departments, such as the creation of the Department of Transportation when our nation's commercial enterprises came to depend on the development of an efficient transportation infrastructure.

There are, however, meritorious reasons to resist establishing new government departments. In any case, NTIA could serve as effectively as the focus for Executive branch telecommunications policymaking if its mandate were clarified and the overlapping grants of authority in Executive Order 12046 were resolved.

Recognizing that a suggestion such as this from the agency involved will doubtlessly appear self-serving, we suggest that as a first order of business, the new Administration thoroughly reexamine the structure and organization of U.S. telecommunications and information policymaking and, at a minimum, take action to centralize responsibility, authorities, and resources. This could be accomplished relatively speedily, and with minimum friction. That it could occur quickly is especially important given the urgency of underlying problems.

Relationship Between the Executive Branch and the FCC

A clearly unified Executive branch, with a mandate for long-range policy planning, would go far toward meeting the challenges of technological advances and foreign developments. It would also minimize the confusion experienced by U.S. companies, foreign telecommunications authorities, and the FCC, which are currently confronted by diverse and conflicting views of individual Federal agencies. Perhaps equally important, the restructuring of Executive branch policymaking would eliminate the incentive and ability for forum shopping in search of a more favorable policy decision.

A restructuring would provide a means for the Administration to balance the trade-offs between national security, trade policy, foreign relations, and economic policy and present a unified Executive branch position to the FCC and the world. Such balancing by a single Administration authority would accentuate the Executive branch's ability to formulate telecommunications and information policy from a holistic, cross-industry, and global perspective at a time when the FCC, ironically, has less and less influence, let alone control, over a wider segment of the telecommunications and information infrastructure.

As discussed earlier, many of the key industries have never been regulated (e.g., computers, VCRs, and information industries), many have been deregulated (e.g., customer premises equipment providers and most interexchange carriers), and many are being subjected to less regulation (e.g., cable television and nondominant common carriers). Thus, not only is an independent agency such as the FCC, with an adjudicatory structure and regulatory orientation, not the appropriate entity to provide telecommunications and information policy leadership, but it is also increasingly uninvolved with many of the most economically important components of the industry.

Unfortunately, even if the Executive restructures its telecommunications responsibilities and authorities, under the existing division of authority, ultimate responsibility for much of the resulting regulatory policy and its implementation would continue to be with the FCC. While the relationship is usually cooperative, in almost all instances the FCC is neither legally required to accept the Executive branch's point of view, nor obligated to accord it particular weight or deference.

Ensuring Policy Leadership

To ensure U.S. regulatory actions are not inconsistent with Administration policy, particularly when such Executive branch areas as foreign policy, national security, and trade policy are involved, one of two approaches can be taken. The first would entail a transfer of the authority to establish policy to the Executive branch.

Under this alternative, the FCC's telecommunications policymaking responsibilities would be transferred to the President. The implementation of those policies, such as the grant of individual licenses and the approval of specific facilities in accord with those policies, would remain with the FCC. Because of the ability of and necessity for the Executive branch to establish consistent national policies which transcend specific sectoral lines, it seems only appropriate that the authority of the President to set forth telecommunications policy should not be compromised by his inability to ensure consistent adoption of those policies. This is particularly important in the area of international telecommunications because the President has Constitutional authority over foreign affairs and has been delegated Congressional authority over international trade and economic policy.

The second alternative is to establish a Presidential disapproval power over FCC telecommunications actions. Again, this authority might or might not be limited to international matters. Such authority would allow the President to advise the FCC before it took an action and then, once the agency had acted, the President could intervene on the basis of overriding national security, foreign policy, international trade or economic policy grounds. Such power could be limited so as to only enable the President to nullify an FCC decision, as opposed to modifying the decision or overriding the Commission's failure to act. The existence of such a power, however, would ensure that the FCC paid close attention to the Executive branch's policy positions.

Conclusions

- International, and sometimes domestic, telecommunications and information policy under the current organizational structure is often reactive and skewed toward achieving short term objectives, focusing too much on maintaining the status quo, despite the influx of technological innovation and marketplace pressures.
- The current structure invites forum shopping, and "divide and conquer" strategies by special interests, including foreign-based, and makes leadership and Congressional oversight difficult.
- A lead telecommunications and information policy agency must have a cross-disciplinary depth of skills encompassing economics, engineering, political science, and communications and intellectual property law, with both domesticand international dimensions.
- The FCC's direct supervisory powers over the overall telecommunications and information industries has steadily diminished due to deregulation of mass media and common carrier markets, increasing market shares of completely unregulated or less regulated industries, and FCC decisions to not regulate certain businesses.
- Despite Congressional and Executive branch calls for improvements over many decades, the structure for telecommunications and information policy-

making remains part of the problem, not the solution to the nation's telecommunications and information policy challenges.

- It has been suggested at different times that a central telecommunications and information policy-making agency be located in the Department of Commerce, the Executive Office as a Special Adviser or Office of Telecommunication Policy, or even as a separate department, such as was created for transportation policy.

Recommendations

- The Executive branch should have the authority to establish policy, while the FCC should remain the agency for implementation of policy.
- Alternatively, the Executive could have the ability to disapprove FCC action, at least in matters of overriding national security, foreign policy, international trade, or economic policy.
- The next Administration should promptly address these issues and consider a more centralized policy-making structure for the Executive branch, with at least a clarification of Executive Order 12046.

NTIA TELECOM 2000

Charting The Course For A New Century

PART TWO

Telecommunications and Information Sector Studies

Executive Summary

I. Local Networks

The local telephone industry is comprised of approximately 1450 companies, with 36 of those companies serving almost 90 percent of households in the United States. Twenty-two Bell Operating Companies, serving 80 percent of households, are subsidiaries of seven Regional Holding Companies, created at the time of the AT&T divestiture. General Telephone (GTE), the largest of the non-Bell, or "independent" telephone companies, is the holding company for 14 local operating companies serving approximately 8 percent of households.

Total operating revenues for the industry have grown steadily over the past few years, increasing annually by 3.8 percent ($73.9 to $82.4 billion) from 1984 through 1986. In 1987, however, revenue growth slowed, with the BOCs' revenues increasing by less than one percent ($62.0 to $62.3 billion). Despite this slowdown in revenue increases, however, net income as a percentage of industry operating revenues has ranged from 12.0 to 14.0 percent annually since 1984. Capital expenditures have also grown over the past few years, as these companies seek to expand and modernize their networks. Between 1984-87, spending on new construction and upgrading network equipment increased 11.7 percent ($17.9 to $20.0 billion).

As of March, 1988, 92.9 percent of the 91 million American households had at least one telephone. Local telephone rates, after increases in the first two years following the AT&T divestiture, generally stabilized and in some instances declined during 1987. In 1987, the level of rate reductions and refunds ordered by state commissions resulted in a net reduction in intrastate revenues of $460 million. This trend has continued through the first six months of 1988, with a net reduction to date of $298 million. By comparison, telephone companies were granted $3.9 billion in additional revenues in 1984.

Nationwide average monthly rates for residential local telephone service range from $9.35 for measured service (with a charge for each call) to $16.61 for flat rate service. Including optional services (e.g., touch tone dialing, inside wiring maintenance plan) and long distance services, the average monthly residential bill is estimated to be approximately $40.00 - 45.00.

Twenty-five states and the District of Columbia have qualified for the FCC's lifeline plan, which provides for a waiver of the federal subscriber line charge (currently at $2.60 per month), as long as states lower local rates by a concurrent amount. Recently, the FCC expanded its lifeline assistance to encourage households currently without telephone service to join the network by providing a $30 credit towards the costs of installation. Thirty-one states and the District of Columbia have been certified under this new plan, known as "Link-Up America."

Current issues regarding local telephone service remain complex and controversial. In addition to traditional challenges, such as preserving affordable, basic service, new challenges have emerged, such as how to efficiently utilize the $220 billion invested in existing local networks and how to manage issues arising from the emergence of competition to existing service providers. Moreover, there is the threat that as the emphasis of regulation shifts from promoting the largely satisfied goal of universal service toward encouragement of innovative services, that an excessive regulatory concern with the potential for cost shifting may be counterproductive.

The future holds the promise of further technological advances in the local network, particularly with respect to switching and transmission. These advances could result in more efficient delivery of existing services and the introduction of new services by local exchange carriers as well as new entrants. In addition to rate stability, the coming years should see an increasing number of states acting to reform their telecommunications laws and regulations. For an increasing number of states, telecommunications will be viewed as a means for improving their economic and business climate.

II. Long Distance Network Services

The long distance market, both for calls in this country and to overseas points, has greatly benefited from deregulatory and procompetitive actions by the FCC. Domestically, the FCC created an open entry environment for interstate services, greatly lessened regulatory burdens on competitive carriers, and continues to explore further possibilities for stimulating competition. With respect to international telecommunications, there have been inroads enabling competitive carriers to provide service to numerous overseas countries, although competition is not as robust as in the domestic market. The extent to which toll calling within the state jurisdictions is competitive varies; but in general, competitive development, while initially slow, has begun to surface.

The drive to make long distance markets effectively competitive has been for the purposes of spurring innovation, producing efficiencies, and creating downward pressure on rates. Many new service and pricing options now available in the long distance market attest to the successful attainment of these goals. Consumers are not only afforded an ever-expanding array of services offered by carriers, but they are also able to employ private systems which may meet their specialized needs.

The advent of satellite service has been a strongly procompetitive force both domestically and overseas. Increased building in fiber capacity has been another significant development producing benefits with respect to long distance services. With increasing numbers of competitors and expanded capacity, it is likely effective competition will continue to exist in the future.

As a result of increased competition, the market share of the former monopoly provider, AT&T, has not surprisingly been declining, particularly in domestic markets and to a lesser extent for overseas service. Nevertheless, long distance usage has tended to increase and also the total revenues produced. This means that all providers, including AT&T could see their revenues move upward.

Consumers are enjoying the benefit of more affordable long distance services, as prices have been dropping significantly in recent years. With such price declines, and increased network stimulation, meaning greater network efficiencies, the public may see prices reduced even more.

In short, both consumers and competitors have greatly benefited from procompetitive initiatives in this area. As a result, it can be expected than new entrants will continue to be attracted to this service market, thereby maintaining effective competition and all the advantages which stem from market forces working successfully for the public.

III. Fiber Optics

Over the past two decades, fiber optics has emerged as a highly practical and cost-efficient communications medium, capable of offering very large transmission capacity, while delivering other advantages as well. In Japan and Western Europe, and in the United States, fiber optics has become competitive with, and has often displaced other communications media as the technology of choice in a number of applications. Research and development efforts, aimed at improving the cost-performance characteristics of this technology, hold great promise for increasing the suitability of this medium for still more applications. As a result, a dynamic transnational industry which manufactures fiber, necessary optical and electronic devices, and related hardware, has grown rapidly in response to these opportunities.

Fiber optic transmission facilities have the potential to offer immense telecommunications capacity compared with its antecedents. In the late 1970s, optical systems were capable of transmitting at the rate of 45 megabits per second (Mbps) or 672 voice channels per fiber, almost 30 times the capacity of standard copper plant. Present systems routinely operate at 565 Mbps, offering 8064 voice channels. While new systems transmit at 1.7 billion or gigabits per second (Gbps), research reports anticipate a commercialization of facilities transmitting trillions of bits per second.

Several dominant companies have emerged as competitors in the United States, Japan, and Western Europe. Although more than 800 companies in the United States are involved in fiber optic production, the domestic market is dominated by a handful of major companies. AT&T and Corning, for example, together account for 75 percent of the U.S. production of actual optical fiber. Siecor and AT&T account for a similar share in the fiber optic cable market. AT&T and Rockwell-Collins are industry leaders in primary component hardware, with the Japanese firms, NEC and Fujitsu, playing a very active role in the U.S. market.

Japan is the second largest producer country in the world, behind the United States with an industry output for fiber optic cable continuing to rise at an average rate of 24 percent yearly. Three Japanese fiber companies dominate the market. Sumitomo, Furukawa, and Fujikura control a combined total of 75 percent of the Japanese market.

Companies both in the United States and abroad are intent on entering both foreign and domestic markets. The U.S. fiber optics market will grow from $774 million in 1986 to $2.9 billion in 1992. The fiber optics market in Europe is projected to rise from $300 million in 1985, to $1.5 billion by 1991. Currently, it is approximately 25 percent of the world market and will reach 35 percent by 1991. Japanese markets are experiencing similar growth rates, with an average annual growth rate (in fiber-km) of almost 200 percent over a five-year period.

IV. Space Communications and Information Systems

Satellites are used to provide services between fixed points (fixed satellite service), between mobile vehicles and fixed points (mobile satellite services), to locate the position of vehicles (radiodetermination and radionavigation services), to measure the properties of the earth's land, ocean surface, and atmosphere from space (satellite remote sensing), and to track weather (weather satellites).

Within the U.S., fixed satellite services are provided primarily via nine domestic systems, with approximately 30 satellites used for a variety of services, including audio and video programming, satellite newsgathering, private line voice and data networks, teleconferencing, videoconferencing, and long distance services.

Twelve foreign countries own and operate satellite systems for the provision of domestic communications. The primary providers of international telecommunications are INTELSAT, INMARSAT, EUTELSAT, ARABSAT, INTERSPUTNIK, and the Palapa system. Today, at least 60 percent of all international telephone calls and almost all intercontinental television relays are via satellite. While maintaining the U.S. commitment to the viability of INTELSAT, the U.S. Government has also authorized the establishment of separate satellite systems, which will help bring competition and new service offerings to the international satellite marketplace.

Whereas satellites were initially separated by five or more degrees of orbital arc, they can now operate, using the same frequency band, in orbital positions as close as two degrees apart. Through continued technical improvement, and the shared use of international and regional satellite systems, the developing nations will be assured of their place in the geostationary orbit whenever they may be ready to launch their own satellites.

Although there are no U.S. domestic high powered Direct Broadcast Satellite (DBS) services, there is a well established low powered satellite television receive-only (TVRO) industry operating within the U.S. A powerful impetus for establishing a DBS system may be as an outlet for high definition television (HDTV).

New on-board baseband switching capabilities of advanced telecommunications satellites will allow Very Small Aperture Terminals (VSATs) to communicate directly via a single hop. As satellite technology continues to develop and be put to use by creative businesses, the communications abundance it has helped provide should continue to function as the backbone and nervous system of international commerce, give more and more people access to better quality education, enhance the conduct of businesses in space, and contribute toward greater peace and understanding.

V. Land Mobile Radio Services

Land mobile radio services, which permit mobile users to communicate with non-stationary, land-based users, have been growing steadily since their inception. The private land mobile radio services, which preceded the public services by more than a decade, were initially devoted to the safety of life and property. And private services grew in light of those objectives. With the sanctioning of land mobile radio use for commercial and industrial applications in the late 1940s, both public and private systems proliferated rapidly. Two services in particular, cellular mobile telephone and specialized mobile radio (SMR) services, have seen very dramatic growth within the last decade.

The growth of land mobile radio services, since their early days, has created periodic problems of radio channel congestion. On several occasions throughout the history of these services the FCC has attempted to alleviate crowding on radio channels, by adopting technical advances in radio development and through periodic allocations of radio spectrum to these services. But over the history of these services, additional allocations of radio spectrum and technical improvements have had difficulty in keeping pace with the ever growing demand for land mobile radio services.

Important land mobile radio issues, evident in the past, are not likely to disappear in the near future. Among the important future concerns will be radio spectrum allocation and license assignment issues, including the manner in which radio spectrum will be allocated, and the amounts allocated among public and private land mobile services, and other uses of radio spectrum. Equally important considerations include the manner in which license assignments are made and the degree of operational and technical flexibility permitted (if any) to each licensee.

VI. Telecommunications Network and Customer Premises Equipment

The U.S. telecommunications network consists of some 22,500 telephone central office installations, more than three billion circuit miles of engineered and in-service transmission capacity, and about 124 million access lines connecting telephone service customers. The telephone equipment market consists of two major categories: customer premises equipment (CPE) and network equipment. Sales of CPE (including computer terminals) totaled about $20 billion in 1986. U.S. product shipments totaled only $5.2 billion, a 22.5 percent drop from 1985 shipments. This market drop has led to increased competition among the numerous suppliers, both domestic and foreign. The overall U.S. domestic network equipment market continued to expand in 1987 to about $14.4 billion, almost a 12 percent increase.

Overall, telephone equipment industry shipments are expected to grow steadily during the next five years at an annual rate of five percent (constant dollars). U.S. domestic shipments of customer premises equipment are forecast to decline by three percent annually over the next five years. Network equipment should increase at about seven percent over the same period. Imports will account for much of the increase. Employment in the U.S. telecommunications equipment industry is expected to decline slightly over the next five years.

The United States registered a 1982 trade surplus of about $275 million in telecommunications equipment which deteriorated to a $2.5 billion trade deficit for 1987. In the broader "electronics-based products" category, results have been more severe. A $4.7 billion U.S. trade surplus in this field in 1982 plunged to a $15.3 billion deficit in 1987. Persistent foreign tariff and nontariff trade barriers are one of the main contributing causes for present U.S. telecommunications trade problems. While the United States rapidly opened large parts of its telecommunications market to competition commencing in the early 1970s, most markets overseas remained largely closed.

Under the AT&T Consent Decree, the Bell companies are flatly barred from engaging in domestic equipment manufacturing for domestic markets. The Bell companies also are required to use open, nondiscriminatory equipment procurement. One apparent effect of the AT&T consent decree has been the increasing U.S. sales enjoyed by most foreign-based equipment suppliers, especially Japan-based firms.

VII. Federal Government Use of Telecommunications

The Federal Government is the largest customer for telecommunications products in the U.S., and perhaps the world. The variety and quantity of telecommunications products and services procured by the Federal Government impacts the U.S. telecommunications industry. Competition in this industry lowers the cost of products and services, but presents its own level of complications to the Government procurement mechanism.

As the national economy shifts from industry-based toward service-based, the population has become more aware of the services that are available, and has begun to expect more and better services from the Federal Government. Faced with this growing expectation about government services, government agencies have begun innovative uses of telecommunications to deliver government services better and with less cost to the taxpayer.

The Federal Telecommunications System (FTS) and its upcoming replacement, FTS 2000, are described in the study, as are the Government's wire-line systems managed by the Defense Communications Agency, the AUTOVON, AUTOSEVOCOM, and the Defense Data Network.

The Federal Government both uses and manages the radio spectrum. In conformance with international regulations, the U.S. manages the spectrum through two Federal organizations, the Federal Communications Commission, and the National Telecommunications and Information Administration.

The Government's use of radiocommunications is pervasive throughout twenty Executive Branch Agencies, with an estimated investment of $80 billion. Some 240,000 frequency assignments authorized by NTIA provide the spectrum required to satisfy the radiocommunications needs of the Federal agencies. The conduct of Government business and the provision of Government services to the public depend to a large degree on radiocommunications.

The formation of the National Communications System and the resulting National Security Emergency Preparedness (NSEP) telecommunications activities, including the National Coordinating Center, has provided a strong national emergency telecommunications infrastructure.

The study concludes that Government expenditures for telecommunications equipment and services will continue to increase, regardless of decreases in the defense budget.

VIII. Postal Services

Postal service is a $44 billion industry consisting of the transportation of mail and packages. The U.S. Postal Service (USPS), a Federal agency, has about 70 percent of this market, exceeded in employment only by the Department of Defense and General Motors, and as a retailer only by Sears Roebuck.

With such a small part of the USPS $30 billion revenues now subsidized by Congress, there is little reason for Congressional oversight. From the standpoint of public policy, there is less reason for the USPS to be a Government agency than there would be for major telecommunication organizations in the transmission of electronic information.

The fact that the USPS is a Government self-regulated monopoly has led to questions each year of whether it should be privatized and the monopoly ended. With the ingenuity of the USPS in using new technology such as optical scanners and automated sorting systems, there is little doubt that it would be a viable competitor, particularly if free to develop competitive pricing strategies and product lines. The USPS estimates that 45 percent of its mail volume and 21 percent of its revenues are most vulnerable to competition.

The basic question is whether the nation will continue to lack the potential benefits of combined postal and electronic mail services, and thereby avoid the possible deterioration of the essential hard copy transportation and delivery service, if the postal and communications industry are not allowed to participate as equals in a unified competitive market.

IX. Information Services

The U.S. market for information services available over telecommunications networks is strong and growing, but mass market customers (small business and residential telephone subscribers using ordinary telephone service) have not fared as well as larger business users and personal computer (PC) owners.

The business information services market is robust, and currently has about $5 billion in annual revenues, with a forecast of $15 billion for 1992. The number of databases doubled between 1981 and 1985, and records contained in databases grew from 52 million in 1975 to 1.68 billion in 1985, a 32-fold increase.

In contrast, the mass market, as represented by videotex progress, has not seen such robust growth. More than two dozen videotex services and systems are in operation in the United States. The total number of subscribers to mass market videotex was slightly over one million in 1987, with revenues of $114.8 million. All are business or residential PC owners with modems and telecommunications software.

The Federal Communications Commission (FCC) has long promoted and maintained an unregulated environment for the offering of information services by non-common carriers, and has been actively involved in establishing the terms and conditions under which certain regulated carriers could offer such services.

The AT&T consent decree court has recently taken on a regulatory role by deciding what types of information services the Bell Companies may or may not provide, and under what terms and conditions. AT&T and GTE are also subject to certain court restrictions affecting their roles in the provision of information services. Further, court restrictions on Bell company manufacturing, as well as related research and development, now prevent those companies from developing or building an information services terminal particularly suitable for mass market applications. Various shortcomings could be rectified if the Bell companies were permitted to manufacture terminals, as well as offer more information services.

X. Electronic Banking and Financial Services

The union of advanced data processing and communications technologies has had a profound impact on banking and other financial service industries. Computerization of these industries, linked by telecommunications, has created new opportunities for consumers, merchants and investors. The increasing speed with which financial transactions can be processed, the volume of those transactions, and the reach of satellite and international cables allow almost instantaneous response to changing market conditions. As a result, a 24-hour global marketplace exists today in which U.S. markets can affect Japanese markets, and in turn European markets.

In order to remain competitive in this environment, bankers, currency traders and securities brokers must be able to respond to market changes at any moment. While not one U.S. bank remains among the world's top ten in terms of total assets, U.S. banks and bank holding companies are approximately twice as profitable as the leading Japanese institutions. This is due, in large part, to U.S. banks' computerized EFT and cash management systems, which, in turn, rely upon communications links. These systems are essential instruments for financial institutions in the new, deregulated marketplace. They lower the cost of processing payments, reduce personnel needs, attract customers, and create new economies of scale. U.S. banks recognize this, and have invested more of their revenues in information systems than any other industry.

The U.S. Government has contributed to the development of the electronic infrastructure in a number of ways: FedWire, the settlement system operated by the Federal Reserve Board, the Department of the Treasury's Vendor Express and benefits disbursement systems; the judiciary's opening of new avenues for information services; and the Federal Communications Commission is proceeding to create open, digital networks. Yet the FCC recently threatened the development of on-line services through a proposed recission of access charge exemptions for enhanced service providers.

As strong deregulatory and competitive forces shape both domestic and international markets, U.S. financial institutions will rely heavily on their electronic communications and data processing capabilities to attract customers, increase financial and nonfinancial service offerings and efficiency, and maintain profits. With extensive computerization and increasingly sophisticated telecommunications networks, the financial services industry will be leading the way toward the futurists' vision of a cashless, checkless society.

XI. Commercial Broadcast Television

Commercial broadcast television is one of the most influential inventions of the twentieth century. Over 1,000 commercial television stations operate in the U.S., most owned by "group owners." Although about two-thirds of all stations are affiliated with one of the three national networks, the number of independent or non-affiliated stations has nearly tripled since 1980. Commercial television is supported by the sale of advertising time, where local sales have been the fastest growing source of revenues.

Historically, television broadcasters have been characterized as "public trustees" because they are licensed in the public interest. Heavily regulated historically, recent FCC decisions have eliminated much governmental oversight of the broadcasting business.

In the past two decades, a number of new distribution technologies have arisen to challenge the historical dominance of commercial broadcast television. More than 80 percent of the nation's households have access to cable television, and more than 50 percent subscribe. Nearly 60 percent of households own at least one VCR. Multichannel Multipoint Distribution Service systems and low power Direct Broadcast Satellite services are emerging to provide multiple channels of programming in areas where cable television is unavailable or inadequate, and may provide competition in cabled areas as well.

While these developments have dramatically expanded viewing choices for consumers, they have eliminated the comfortable market conditions that television broadcasters have enjoyed over the years. The three broadcast networks have been especially affected, experiencing declining ratings, stagnating advertising revenues, and shrinking profit margins. More and more independent stations are also having difficulty surviving in an increasingly competitive market.

The implementation of High Definition Television (HDTV) may be difficult and expensive for broadcasters, but it appears essential for broadcasters to find a way to upgrade their facilities to provide HDTV to consumers so as to remain competitive with the virtually certain introduction of HDTV by cable, VCRs and perhaps direct broadcast satellite.

Despite these and other challenges, the medium is still thriving because of the tremendous need of advertisers to have access to large audiences. So long as commercial broadcast television continues to be the most effective way for advertisers to reach consumers, it will remain a vital, important force in our economy and society.

XII. Commercial Radio Broadcasting

The radio industry has faced competitive challenges from several new media over the last half century, and perhaps because of these "trials by fire," has become a resilient, adaptable medium.

About 10,000 radio stations operate on the AM and FM band, providing music, news, entertainment, and other information. The audience has generally shifted from AM stations to FM stations in the last 10 years.

The sale of advertising time occurs in three primary ways: network sales on radio networks serving the country over affiliate systems; local sales by local stations; and spot sales through "rep" firms, where national advertisers place ads on specific stations. Network revenues were slightly off in 1987, although local sales would increase by about six percent over 1986.

Early FCC regulation limited network control over affiliates. Longer license terms, a simpler renewal application process, no minimum license holding period, and more lenient limits on station ownership have been highlights of the general trend toward deregulation.

Advances in technology have created opportunities for new networks and program services, using satellite delivery. In addition, compact discs are increasingly used in radio studios. Subcarriers (SCAs) of FM signals are used by about 41 percent of FM stations to generate new revenues from the delivery of voice and data and for utility load management.

Current issues before the industry and regulatory bodies include: reducing Cuban interference to U.S. stations; increasing minority ownership of stations; streamlining the comparative renewal process and eliminating abuse of that process; improving techniques used to measure audiences and other data; and resolving disputes over content, including special broadcast regulations like the "fairness doctrine", and indecent program material and music lyrics.

Another major issue is whether the AM service will regain its competitiveness with FM and other audio services. Some steps are being taken to improve the sound and signal quality of the AM service, but it is not clear whether innovative programming formats will attract new, younger listeners back to the AM band.

It is forecast that industry revenues should increase over the next three to five years in the high single digit range. In general, radio is a healthy medium that will be remain strong for a very long time.

XIII. Cable Television

Cable television has become a substantial element of the nation's video landscape. This change was made possible by two important developments. First, technology allowed for the development of distribution systems designed to transmit television programming to cable systems. Second, regulatory and judicial decisions provided cable operators with increased flexibility and opportunities to offer an increasingly diverse menu of alternative program options to homes wired by cable.

The cable television industry has matured over the last few years. Currently, 80 percent of the television households in the United States have access to cable television, although too many areas are not yet cabled due to failures of the local franchising process. As a result, the cable industry is shifting its focus away from expanding physical plant to an emphasis on taking the right steps to ensure its long-term profitability.

First, the industry has shown a growing willingness in recent years to compete head-to-head with the broadcast industry. Examples of this include the industry's increasing reliance on cable-exclusive programming and the substantial growth in direct advertising on cable.

Second, today the cable television industry has considerably more discretion over the rates it charges and over the programming it provides subscribers. These two developments portend a dramatic shift in both the quantity and quality of programming the cable operator will offer and the rates charged for such programming.

Despite these developments, the cable industry faces several important challenges. Rate deregulation and the elimination of the "must-carry" rules have given the industry new flexibility. However, increasingly there are calls for the end of the compulsory license, whereby cable systems obtain use of broadcast programming for retransmission at prescribed rates, for investigations into the levels of horizontal concentration and vertical integration in the industry, and more competition in local service areas.

Moreover, the possibility exists that cable operators will face competition from local telephone companies in the not too distant future. The ability of the cable industry to successfully meet these and other challenges will determine whether the industry will be able to maintain its current level of financial success.

XIV. Public Broadcasting

The history of public broadcasting and its educational applications spans from the days of experimental radio in the 1920s to today's advanced telecommunications applications which include utilizing a satellite network. Initially created as a noncommercial service to provide educational and instructional programs to students and the public via radio and television, public telecommunications has evolved into a contemporary service which also provides cultural, entertainment, and informational programming.

The Federal Communications Commission (FCC) and Congress have through the years stimulated and protected the growth of noncommercial services for the benefit of the public. The FCC reserved channels for noncommercial and educational broadcast use. Congress developed legislation to help fund the system and authorized organizations to help the growth of public broadcasting. Today, these organizations function as funding and programming sources for public radio and television broadcasting. NTIA's Public Telecommunications Facilities Program provides funds for equipment needs.

While public broadcasting continues to develop as an entertainment and educational medium, many nonbroadcast technologies are also being used for instructional purposes. The noncommercial system is evolving so that broadcasters and educators can take advantage of the potential for all technologies to provide a wealth of services to the public. Those technologies include cable, Instructional Fixed Television Service, computers, and data communications links.

Public broadcasting is now available to 97 percent of households. Instructional programming is carried by 99 percent of public television licensees.

Although some concerns such as how to continue funding these services remain, and new concerns such as cutbacks in coverage achieved through cable systems have emerged, in general, future projections for the industry are positive. Many government, industry, and legislative representatives support the public, educational, and instructional services of the system and are examining ways to improve and strengthen it for the future.

What drives expansion of public broadcasting and its educational applications in the 1990s will depend largely on the creative use of technologies, creative financing, and creative policymaking. If these driving forces can come together, public broadcasting will produce new perspectives on services to the public.

XV. The Film and Video Industries

The film and video industries operate at three levels roughly similar to production, wholesale, and retail sales of tangible goods: (1) producers of programming, (2) distributors or syndicators, and (3) exhibitors, broadcasters, and retail home video stores. Films and video programs are generally not sold but are licensed for limited use by theaters, broadcast television, cable, and home video in sequential distribution both in the United States and abroad The theatrical film industry, the first to develop, is an important source of revenue but is increasingly important today because of its ability to influence the popularity of products in ancillary markets like home video, pay cable, and international distribution. The television industry is splitting into segments, all of which need products; these are the broadcast networks, syndicated to independent stations and cable networks. The home video market which did not exist a decade ago, has gained an extremely important place in the business through its ability to generate billion dollar revenues.

In 1987, U.S. theatrical box office revenues broke the 1984 record. The price of television programming continued to skyrocket, and VCR penetration passed the 50 percent point of all U.S. homes.

In 1988, each segment of the industry faced significant challenges. theatrical exhibitors worry that pay-per-view cable services and increasing use of VCRs will cut down audiences; broadcast programming costs need to be cut, particularly since the television networks, a major source of production financing, are experiencing significant declines in audiences from increased competition; the VCR business needs to get audiences to buy more tapes than to rent them; and the pay-cable competitors are engaged in bidding wars to secure exclusive rights to programming.

Along with new technologies creating new markets (like pay-per-view and home video) the most important new factors in the industries are the rise of independent producers and expanding international markets.

The forecast is bright for those firms able to react quickly and effectively in this dynamic sector. It is indisputable that although technology may change, there will be continually increasing demand for the products of the film and video industries.

XVI. Consumer Electronics

Consumer electronics includes television receivers, radios, phonographs, video cassette recorders, audio tape recorders, stereo system components, automobile radios, tape players, video cameras, citizen band radios, home security systems, and a number of other electronic products.

The consumer electronics market has basically developed over the past decade and in that time period has quadrupled in size. Factory sales of consumer electronics in the United States for 1987 were estimated at $30.4 billion compared to $29.8 billion in 1986 and $8.2 billion in 1977. A large portion of these sales come from video products -- approximately $13 billion.

The shipment of television sets accounts for 72 percent of consumer electronics produced in the United States. With a French electronics company purchase of General Electric's consumer electronics division, there is now only one major U.S.-based manufacturer of television sets, and several of its investors are attempting to have the parent company sell the consumer electronics business.

Videocassette recorders have become more affordable and have entered a large number of households. Sales of compact disc players have increased dramatically over the past few years. With manufactures taking advantage of digital technology, the consumer will be soon introduced, if not already, to digital equipment including video cassette recorders, television sets, and tape players. The digital audio tape player works so well that certain parties would like to modify the player in order to curb its ability to tape near perfect duplicates of an original score of music.

With the advent of digital technology, the household might change radically in the near future. The house might become "smarter" than the owner -- taking care of the climate control, letting the dog in and out of the house, maintaining security, and helping watch the children.

The consumer electronics sector is expected to experience three to four percent growth in the coming years. Such growth is small for an industry that has quadrupled in market size over the past ten years. Reasons for conservative growth projections include announcement of manufacturers' intentions to raise prices for certain consumer electronics and the absence of a revolutionary product to provide substantial growth similar to the growth attributed to the introduction of the videocassette recorder.

XVII. Communications and Information in Rural America

The provision of high quality, reasonably priced telecommunications services to subscribers in rural areas and and the development and maintenance of the telecommunications infrastructure has long been recognized as a major policy goal of Federal and state policymakers.

Historically, government has provided various programs, incentives, and initiatives to further the growth of rural telecommunications. The Rural Electrification Administration has been a key player in the past fifty years in stimulating the growth and expansion of telecommunications across rural areas of the country through its loan program. The NTIA has provided various economic incentives to support the growth and expansion of telecommunications facilities through its Public Telecommunications Facilities Program. The FCC has played an integral role in the establishment of various incentives such as the Link Up America Program, Universal Service Fund, and Lifeline Service. Congress has initiated reform measures which support the continuance of REA while improving the loan recipient requirement process.

The deployment of new telecommunications technologies in rural areas may lead to the development of services comparable to urban areas. In the past, service quality has been lower and costs higher due to the inherent nature of rural environments. Through new technologies such as cellular digital radio, Basic Enhanced Telecommunications Radio Service (BETRS), Television Receive Only (TVRO), and Mobile System Satellite (MSS), it is possible that telecommunications service in rural areas will be comparable to the already existing telecommunications services in metropolitan areas.

Further, the development of rural telecommunications networks and infrastructure continues to emerge. Currently, regulators and rural telephone organizations are dealing with various post-divestiture and deregulatory issues affecting rural telephone service companies. Pricing policies and rate averaging which, in the past, have helped keep rates below actual costs and in line with the national average for rural subscribers are currently being debated and reformed. In addition, joint ventures between various independent companies such as Iowa Network Services, are bringing together local exchange companies to provide the benefits of equal access and competition to subscribers in a more rural market.

I

Local Networks

by Terry Monroe

Local telephone service is provided by 22 Bell Operating Companies (BOCs),[1] serving approximately 80 percent of the 84 million U.S. households with telephone service; 14 General Telephone Companies (GTE) with about 8 percent of households, and approximately 1400 other "Independent" companies serving the remainder of households. According to a recent Fortune survey of the top 50 utilities, the BOCs and GTE accounted for eight of the top ten positions, with combined assets of $180.6 billion and operating revenues (for both telephone and non-telephone operations) of $85.2 billion.[2]

Prior to the AT&T divestiture in 1984, local service was defined as a call between any two points within a single "exchange" or "zone." Exchanges varied in size, from a few hundred subscribers in some rural areas, to millions of subscribers in large urban areas. As of 1986, there were 19,400 exchanges in the United States, of which the BOCs served 7,623, while the Independents accounted for 11,777 exchanges.[3]

With the AT&T consent decree, 164 court-approved "Local Access and Transport Areas" (LATAs) were established. Today, local calls within the serving area of a BOC are also referred to as intraexchange, intraLATA calls. Within their local service area, the "local exchange carriers," (LECs) provide a myriad of services in addition to basic exchange service. For example, all may provide long distance (i.e., toll) service between exchanges within their LATAs (interexchange, intraLATA toll). In addition, these carriers offer "transport" services, which allows the movement of information within the LATA. Transport services can be further divided into three categories: point-to-point, point-to-multipoint, and multipoint-to-multipoint. The first two are generally provided through dedicated (i.e., private) lines and are used primarily by business customers. Multipoint-to-multipoint services are most commonly associated with basic local telephone service, used by both business and residential customers.

In addition, local exchange carriers provide access to long distance carriers. Access is most commonly provided through the public switched network. At certain usage levels, however, it may be more economical for customers to utilize a direct, nonswitched facility to connect premises to a long distance carrier. Such access may be obtained either from the LEC (referred to as "special" access) or as in the case with transport services, the customers could choose to lease or build facilities separate from the local exchange carrier.

Local calling continues to represent a substantial majority (approximately 90 percent) of the total number of calls made by subscribers.[4] Local service subscribers, in turn, are basically divided into two groups: residential and business, with the former accounting for 71 percent of access lines.[5] For residential subscribers, basic exchange service traditionally has meant paying one rate for the ability to make an unlimited amount of local calls per month (i.e., flat rate service). Today, however, an increasing number of subscribers are also provided the option of measured service. Measured service is generally more available in urban areas, where the equipment necessary to measure local calls is more prevalent. Measured service offers a lower "dial tone" charge, with additional charges levied for each local call above a certain number per month. Those additional charges are based either on a per call basis (often referred to as "message rate service") or a per minute basis.[6]

Key Industry Statistics

Revenues and Income

Total operating revenues for the industry have grown steadily over the past few years, increasing at an annual rate of 3.8 percent ($73.9 to $82.4 billion) for the years 1984 through 1986 (1987 data not available).[7] The Regional Bell Holding Companies, who represent the largest percentage of industry revenues, saw their total revenues increase at an annual rate of 5.4 percent ($57.9 to $67.3 billion) during that same period. In 1987, revenue growth slowed to 3.7 percent ($67.3 to $69.8 billion).[8] For their traditional telephone business, the BOCs saw their operating revenues increase at an annual rate of 2.6 percent ($57.5 to $62.0 billion) between 1984 and 1986. For 1987, however, revenues increased only 0.5 percent ($62.0 to 62.3 billion).[9]

Due primarily to strong growth in its diversified businesses (GTE Spacenet, GTE Mobilnet, GTE Directories, and GTE Airfone), GTE's revenues increased annually by 5.9 percent ($9.6 to $11.3 billion) from 1984 through 1986.[10] For 1987, however, revenue growth slowed to 4.6 percent. For its traditional telephone business, GTE's revenues increased at an annual rate of 3.5 percent ($8.5 to $9.4 billion) from 1984 through 1986.[11] As with the BOCs, however, the level of revenues earned in 1987 effectively was unchanged from 1986.[12] For the Independents as a group (including GTE), revenues increased by an annual average of 4.8 percent ($16.0 to $18.3 million) between 1984 and 1986 (1987 data not available).[13]

Local service revenues, which account for the largest percentage of operating revenues (46 percent), topped $35.5 billion in 1986, for an annual increase of 3.8 percent since 1984 (1987 data not available).[14] For the BOCs, local service revenues increased at an annual rate of 4.3 percent ($25.3 to $28.6 billion) from 1984 through 1986, diminishing to 2.1 percent in 1987.[15] While local rate increases, particularly in 1984, account for some of the growth through 1986, a greater percentage of that growth appears to have resulted from higher calling volumes and increases in the number of customer access lines.[16] While growth in calling volumes and customer access lines continued in 1987, this growth was offset primarily by rate reductions resulting from the lower federal tax rate.

The second largest category of revenues for local exchange carriers is for network access. Such access is used for originating and completing interstate and intrastate toll calls. As of 1986, local exchange carriers' network access revenues (comprising 32 percent of total operating revenues) were $26.5 billion, an annual increase of 6.6 percent since 1984 (1987 data not available).[17] For the BOCs in particular, network access revenues increased annually by 5.8 percent over the same period ($16.8 to $19.7 billion).[18] In 1987, revenue growth flattened out from the previous year ($19.5 billion). Unlike previous years, FCC-mandated reductions in interstate access charges for 1987 did not appear to be offset by increases in demand for interstate access.

The third largest component of revenues is comprised from toll service. From 1984 through 1986, industry revenues increased annually by 1.1 percent ($12.3 to $12.7 billion). For the BOCs, limited by the AT&T Consent Decree to providing only intrastate, intraLATA toll, revenues increased at an annual rate of 2.3 percent ($8.6 to $9.2 billion) during the same period[19] For 1987, however, BOC toll revenues jumped 7.6 percent ($9.2 to $9.9 billion).[20]

Net income as a percentage of industry operating revenues has remained constant since 1984. In 1986, net income was $11 billion, or 13.47 percent of total operating revenues, compared with $9.3 billion, or 12.71 percent of revenues in 1984.[21] The Independents have reported higher net income (as a percentage of revenues) than the BOCs. In 1984, the Independents averaged 14.28 percent ($2.2 billion), compared with 12.29 percent ($7.1 billion) for the BOCs. Similarly in 1986, the Independents averaged 14.90 percent ($2.6 billion) as compared with 13.06 percent ($8.3 billion) for the BOCs.[22]

Despite a slowdown in the growth of operating revenues for 1987, the BOCs' net income as a percentage of revenues was 11.91 percent (1987 data not available for Independents). Thus, while the BOCs' revenue growth slowed in the past year, it appears this was offset in part by continued efforts to control operating expenses (as well as lower federal income tax expenses).

Capital Expenditures

Capital expenditures by the local telephone companies have also grown over the past few years as these companies seek to expand and modernize their networks. For the BOCs, a large portion of their recent capital budgets were targeted toward fulfilling the equal access ("1+" Dialing) requirements of the AT&T Consent Decree. As of December 31, 1987, the BOCs had converted 84.2 percent of their lines to equal access.[23] Between 1984-87, industry spending on new construction and equipment upgrading increased 11.7 percent ($17.9 to 20.0 billion).[24] While the rate of spending is projected to slow in 1988, the aggregate level of expenditures should continue to remain high, exceeding $19.8 billion.[25]

The BOCs accounted for 70 percent of the $20.0 billion in expenditures by local operating companies in 1987, with most of those expenditures financed by internally generated funds. While trailing the BOCs in the absolute amount of capital expenditures, the Independents, primarily the top 18 companies, are nonetheless, also seeking to invest in network improvements. For example, GTE, at $2.5 billion, was second only to BellSouth ($3.0 billion) in aggregate expenditures in 1987.[26] In addition, the next four largest independents (United, Continental, Southern New England Telephone and Centel) collectively accounted for another $1.7 billion.[27] The Independents have also been aggressive in their conversion of central offices from step-by-step to digital switches, with more than 40 percent of local switches being digital as of June, 1987.[28] It is estimated, for example, that electromechanical central office switches are being replaced with electronic analog and digital switches at a rate of one every day.[29] Switches, cable (copper and optical), and transmission equipment accounted for approximately 75 percent of the local exchange companies' capital expenditures in 1987.[30]

Rates and Subscribership Levels

As of March 1988, 92.9 percent of the 91 million households in the United States had at least one telephone, while 94.6 percent of households have access to a telephone either at home or elsewhere.[31] Both figures are at their highest levels since the Census Bureau began collecting such data as part of the Current Population Survey.[32] In addition, since the first data were collected in November 1983, nearly one million households previously without telephone service have been added to the network.[33]

Local telephone rates, after increases in the first two years following the AT&T divestiture, generally have stabilized and in some instances declined in the past year. In 1987, for example, state commissions considered only $93.4 million in revenue increases for local telephone companies, compared with $7.32 billion in 1984.[34] This trend continued into the first six months of 1988, with state commissions considering only $14.7 million in revenue increases.[35]

Equally important is that fact that the level of requests granted has declined significantly. In 1984, for example, telephone companies were granted revenue increases of $3.9 billion, or 53%, of the total considered by state commissions.[36] In 1987, however, the level of rate reductions and refunds ordered by state commissions resulted in a net reduction in intrastate revenues of $460 million.[37] The reductions and refunds continued through the first six months of 1988, with a net reduction totaling $298 million.[38]

One explanation for the lower rate requests and higher level of reductions is the recent change in the federal tax law, which lowered the corporate income tax rate from 46 to 34 percent. The National Association of Regulatory Utility Commissioners (NARUC) estimates the tax savings to AT&T and the local telephone companies resulting from federal tax reform to be $6 billion dollars per year.[39]

In a few instances, states have used the tax savings to allow the local operating companies to reduce their depreciation reserve deficiencies. The more common response, however, has been to require the local operating companies to adjust their rates to reflect the changes in the corporate tax rate (for many states, current revenue requirements were established when the tax rate was 46 percent).[40]

The days of large rate increases, moreover, are not expected to return soon, due to the decline in interest rates from their record high levels in the early 1980s as well as efforts by the LECs to reduce their operating costs. Since 1984, for example, the BOCs have reduced their telephone operations employee base by 11 percent (538,007 to 478,360),[41] while at the same time, investing in new technology (e.g., digital switches, fiber optics) which, in the long run, should lower the marginal costs of service. Finally, the prospects of regulatory reform have encouraged BOCs in at least nine states to accept rate moratoriums ranging from 3-5 years.[42]

Current estimates are that the nationwide average for flat rate residential local telephone service (including the subscriber line charge) is $16.61 per month.[43] Including the cost of optional services (e.g., touch tone dialing, inside wiring maintenance plan) and long distance services, the average monthly residential bill is estimated to be approximately $40.00-$45.00.[44] By comparison, in 1983, the year prior to divestiture, the average bill for similar service was estimated at $35.00-$40.00 monthly.[45]

Lower priced, measured service alternatives also are available in most states, at an average monthly rate of $9.35 (this includes a package of 50 "free" calls per month).[46] Measured rate service for low-usage subscribers (charge for each call) averages approximately $7.00 per month.[47] The growing availability of measured service options has meant lower monthly local service bills for many subscribers.[48] Local telephone rates for rural subscribers continue to remain lower generally than in urban areas.[49]

In addition, the FCC, in conjunction with the states and local telephone companies, has established "lifeline" programs designed to help low-income and disadvantaged individuals afford telephone service. Twenty-five states and the District of Columbia have qualified for full assistance under the FCC's "lifeline" plan, which provides for a waiver of the federal subscriber line charge (currently at $2.60 per month), as long as states lower local rates by a concurrent amount.[50] Recently, the FCC expanded its lifeline assistance to encourage households currently without telephone service to join the network by providing a $30 credit towards the costs of installation.[51] Thirty-one states and the District of Columbia have been certified under the "Link Up America" program.[52] Assistance is limited to those individuals who can meet a "means" test (such as eligibility for food stamps or Medicaid) and verify their eligibility for benefits under such programs. Funding for the federal contribution to these programs comes from interexchange carriers. In its first six months of operation, "Link Up America" made it possible for 13,995 low-income households to obtain telephone service, based on the results of four pilot programs (Arkansas, District of Columbia, Texas and West Virginia).[53]

Thus, despite substantial changes in the structure of the telephone industry over the past twenty years, the following table shows that, compared to other "essential" commodities such as food, housing, fuel, utilities, and medical care, local telephone service during that period has remained an excellent value for most consumers.[54]

TABLE 1
Indexes for Selected Commodities

Commodity	Index
Fuel (Home oil, piped gas & electricity)	471.6
Medical Care	467.8
Housing	375.4
Food and Beverages	326.9
Local Telephone Service	203.7

Indexes: 1967 = 100 (unadjusted)
(As of September 1987)
Source: U.S. Department of Labor

Critical Industry Developments

Historical Overview

In the early years of the telephone industry, telephone companies recovered the total costs of providing local telephone service directly from subscribers of that service. Local exchange plant and equipment costs (also referred to as "fixed costs") were allocated between the interstate and intrastate service based upon the relative usage of local facilities for each type of call. Beginning in 1952, however, measures of relative use were weighted so as to assign an increasing share of local fixed costs to interstate service. This process accelerated in the 1960s and by 1981, the "separations and settlements"[55] process had apportioned on average over 26 percent of the costs of local exchange plant and equipment to the interstate service, although interstate usage nationwide was only about 8 percent. This burden borne by toll subscribers increased at the same time that the costs of interstate service were declining because of advances in the underlying technology.[56]

Another factor that contributed to artificially low residential rates was the long-term depreciation schedules prescribed by regulators for local fixed plant and equipment. By recovering telephone company investment in plant and equipment over many years (e.g., 30-40 years), ratepayers were required to bear only a small burden of depreciation costs each year. So long as technology remained stable, this was not a problem.

The political unpopularity of rate increases, moreover, made it easier for regulators to shift some of the costs of residential service to business customers, who were heavily dependent on service from the local operating companies.

Consequently, in addition to subsidies between local and long-distance, there were subsidies flowing among various classes of customers for each service.

As a result of these practices, increases in the price of residential local telephone service through the early 1980s remained well below both increases in the CPI and the wage rate for U.S. workers. Over a 30-year period (1950-1980), the price of residential local telephone service fell in real dollar terms. In 1950, the average monthly charge for residential service in current dollars was $4.29. In 1980, the charge had risen in current dollars to $8.61. However, when the 1950 rates are adjusted to account for the actual purchasing power of money in 1980, the average monthly charge for phone service in 1950 would have been $14.58, or almost $6 greater than in 1980.[57] (See Table 4). Expressed another way, by 1980, the average worker had to work less than 1 1/2 hours per month to pay for his local telephone service, compared with six hours in 1940.[58]

One benefit of low-priced residential local service was that it helped the United States achieve the goal of "universal service." As the goal of universal service was being achieved, however, the costs of providing local service were increasing. By 1982, the Congressional Budget Office estimated the local loop revenue requirement (wiring connecting subscribers to central offices) was $24 billion. When the costs of CPE and inside wiring were added, subscriber plant costs in 1982 totalled $39 billion while industry revenues were $80 billion. On a per line basis, the fixed plant costs of providing service were estimated at more than $25.00 per month, while local rates were on average less than half that amount.[59] As a result of the separation procedures previously discussed, interstate customers were asked to bear a disproportionate share of local costs through higher long distance rates. By 1984, this interstate subsidy of local service was estimated at $11 billion per year, or 14 cents per minute for each interstate call.

Rapid advances in technology and increased competition, however, made continuation of the traditional cost allocation and pricing policies infeasible. It was thought that without changes to bring rates closer in line with actual costs, large volume customers might bypass the public switched network, which in turn, would leave the local operating companies unable to recover their substantial fixed costs through existing rates. As a result, prices could increase substantially for those remaining subscribers (mostly residential and small business) on the public network. FCC actions in the early 1980s were, in part, a response to this concern.

Divestiture and Competition

At the same time the FCC was reexamining its pricing and cost allocation policies, the AT&T antitrust suit was being settled, with AT&T agreeing to divest itself of its 22 operating companies. In the wake of the AT&T divestiture, local operating companies requested significant rate increases from state public utility commissions. In the first six months of 1984, state commissions considered revenue increases totalling six billion, of which little over one-half ($3.1 billion) was granted by state commissioners.[60] For the year, state commissioners granted companies $3.9 billion (53 percent) of the $7.3 billion they considered.[61] Consumers, in turn, saw their telephone bills for local service increase on average by 17.1 percent in 1984.

Much of the blame for these rate increases was linked to the AT&T divestiture. It is possible that in the confusion and uncertainly surrounding divestiture, and its projected impact on the BOCs, the magnitude of rate increases was greater than normally might have been expected. It is true that some of the direct changes associated with divestiture affected local rates, although not to the degree imagined. For in addition to divestiture, there were other changes occurring which also had a short-term impact on local rates.

1. Loss of CPE and Toll Revenues

Perhaps the major revenue loss for the BOCs resulting from divestiture came about with the transfer of customer premises equipment back to AT&T. Prior to divestiture, the BOCs earned significant revenues from the leasing of telephone instruments to residential and business customers, which helped to keep down monthly local service rates. Southwestern Bell, for example, estimates that leased equipment contributed $1.14 billion to its revenues in 1983. NYNEX estimates that it lost approximately $500 to $550 million in revenues with divestiture.[62]

Divestiture also resulted in the loss of toll revenues associated with the provision of certain long distance services. While much of this revenue loss was made up through the imposition of access charges on long distance carriers, it was often not sufficient to fully recover the revenues associated with long distance service. NYNEX and Southwestern, for example, each experienced a decrease in toll revenues of approximately $500 million in 1984, even after accounting for interstate and intrastate access charges.[63]

2. Depreciation

Another factor which appears responsible in part for the increases in local service rates is the FCC's 1980 decision to change depreciation methods for interstate investment.[64] It was the Commission's intent to allow for quicker recovery of capital investment which would reflect more accurately the economic life of telephone plant and equipment. Because of the early retirement of existing plant in the 1970s, due primarily to the rapid conversion from electromechanical to electronic switching, the industry's depreciation reserve (i.e., the accumulation of annual depreciation expense) was estimated at $21 billion by 1983.[65]

By reforming its depreciation standards, the FCC sought to reduce the current reserve deficiency as well as provide incentives for future capital investment embodying new technologies, which, in the long-run, would enable the local operating companies to more efficiently manage their networks and reduce their costs. In the short run, however, this faster recovery of capital investment would mean higher monthly rates for customers.

In its 1983 Preemption Order, the Commission extended its depreciation policy to the states, preempting inconsistent state depreciation regulations for intrastate ratemaking purposes. As a result of this decision, many operating companies asked for, and won, higher depreciation rates for intrastate services from their state commissions, with a resulting increase in local rates. On May 27, 1986, however, the U.S. Supreme Court held that the FCC cannot require the states to use

FCC-prescribed depreciation rates.[66] As a result of that decision, many states have extended intrastate depreciation schedules and reduced annual depreciation charges, although some (e.g., Illinois) continue to support accelerated depreciation.[67]

3. Jurisdictional Cost Allocation

A second FCC decision which directly affected local service rates was the change in the jurisdictional allocation of local fixed plant costs used for both interstate and intrastate communications. Concerned that an increasing share of these costs was being shifted to the interstate sector, the FCC in 1982 temporarily froze the percentage of fixed costs allocated to the interstate jurisdiction (also known as the "subscriber plant factor" {SPF}) at 1981 levels pending further examination of the separations process by a Federal-State Joint Board (comprised of four state and three FCC commissioners).[68]

Late in 1983, upon the recommendation of a Joint Board, the FCC extended the cap on interstate cost allocations until January 1, 1986, to be followed by a transition period during which a 25 percent interstate allocation would be implemented in four equal steps. In high cost areas (i.e., current allocation is above 25 percent), this transition meant that the level of costs allocated to interstate service would diminish, thereby increasing pressures to raise local rates. Recognizing this potential for significant local rate increases, the FCC ordered the new allocation factor to be supplemented with direct assistance to those areas (in many cases rural) with total fixed local exchange costs in excess of the national average.[69] One year later, after the Joint Board's reconsideration, the Commission ordered the transition to the 25 percent allocation formula to be implemented in eight steps.[70]

As a result of freezing the interstate allocation in 1982, local operating companies have not been able to shift an increasing share of subscriber plant costs to interstate ratepayers. In a 1985 report, the staff of the D.C. Public Service Commission concluded that the costs to be recovered through the intrastate jurisdiction would be $5.1 million (or $1.24 per month per line) greater because of the FCC's action.[71] In addition, they estimated that the transition to a 25 percent allocator (at the time, D.C.'s allocator was 43.8 percent) would impose an additional total monthly cost of $2.80 per access line.[72] Over the eight years of the allocator phase down, this would result in a yearly access line increase of 35 cents.

While the institution of the 25 percent allocation factor will lower the burden on interstate ratepayers in low-cost areas, subscribers may be asked to bear more of the local fixed costs in high-cost areas which will lose some of their interstate subsidies. Through its high-cost assistance fund, however, the FCC seeks to minimize the potential for significant increases in intrastate cost allocation, and thus, increases in local rates. Finally, there is the issue of those areas with high local costs, but low interstate usage (and thus a small interstate allocation). In those cases, as the interstate allocation rises to 25 percent, these areas actually could see a reduction in their local service revenue requirements.

4. Access Charges

The FCC action which perhaps has received the most attention over the past few years has been the imposition of access charges -- commonly referred to as "subscriber line charges" -- on residential and business customers. Access charges are intended to replace the traditional practice of recovering a portion of local fixed costs from interstate services.

Current Issues

Four years after the AT&T divestiture, the issues concerning the local network remain complex and controversial. In addition to traditional issues, such as maintaining affordable, basic service, new issues have emerged, such as how to efficiently utilize the $220 billion invested into the local network. There is the threat that as the emphasis of regulation shifts from promoting the largely satisfied goal of universal service toward encouragement of innovative services, an excessive regulatory concern with the potential for cost shifting may be counterproductive. If, in fact, innovative service amounts to finding new and creative ways to unlock the telephone resource, this would seem potentially inconsistent with attempts to ensure that regulated resources not be applied or even available to non-regulated endeavors. In short, the concepts of synergy and cross-subsidy may need to be reconciled.

1. Local Exchange Competition

One of the fundamental issues in telecommunications today is the degree to which local exchange companies do and should face competition for their service offerings. The level of competition has important implications for a variety of policy issues facing federal and state regulators. For example, the FCC's Computer III rules are intended to weigh the interests of the BOCs who seek to enter new services with those of potential competitors who seek an equal opportunity to participate in the local exchange market. The level of local exchange competition was also the central focus of the court in its recent review of the AT&T Consent Decree.[73]

As noted earlier, one of the stated reasons for institution of subscriber line charges was to eliminate pricing distortions which may cause carriers and high volume customers to abandon the public switched network. Such occurrences are more likely as the number of non-LEC providers increases. Finally, some state regulators are evaluating whether to reduce the level of LEC regulation in their jurisdictions. The manner and extent of future regulatory scrutiny by state authorities may depend upon an evaluation of potential and actual competition faced by the LECs.

In a February, 1987 report, NTIA examined the level of competition in the local exchange market. The report concluded there are increasing opportunities for firms to offer services in competition with the LECs. First, technological changes have produced (and lowered the cost of) various transmission media and equipment that can be employed by users or alternative providers. Second, regulatory decisions have fostered competition by reducing legal barriers to entry and authorizing new service arrangements for local distribution of traffic. Finally, greater sophistication of many users and changing communications needs are generating new market niches for competitive systems. Among the alternative systems discussed were: (1) private microwave; (2) fiber; (3) cable television; (4) cellular radio; (5) digital termination systems; (6) teleports; (7) satellite systems; and (8) shared tenant services.[74] The result has been that competition to local exchange carriers appears to be increasing, at least with respect to central business districts in the largest metropolitan areas (e.g., New York, Chicago, Boston and Washington, D.C.)

2. Computer III & Cost Allocation

Since the mid-1960s, the FCC has wrestled with the question of how to deal with the convergence of communications and computer technologies (and applications). In its three "computer inquiries", the Commission has sought to resolve the questions of: (1) determining which services and equipment should be subject to traditional common carrier regulation; (2) establishing and enforcing a line of demarcation between regulated communications and unregulated data processing services, and (3) defining terms and conditions for telephone companies' participation in unregulated markets.

In its most recent inquiry ("Computer III"), the FCC focused primarily on the later two questions. While reaffirming its basic/enhanced dichotomy adopted in Computer II, the FCC eliminated its separate subsidiary requirements for the provision of enhanced services by AT&T and the BOCs, replacing them instead with cost allocation and accounting rules.[75] In addition, the FCC also introduced the concepts of "Comparatively Efficient Interconnection" (CEI) and "Open Network Architecture (ONA). Under ONA, the BOCs are required to unbundle their service offerings into "basic service elements."[76] These basic service elements must be offered under tariff and provide customers with interconnection "comparably equal" to that which the telephone companies themselves would use for their provision of enhanced services. The FCC currently is reviewing the BOCs' ONA filings submitted earlier this year, as well as comments from interested parties on the merits of the ONA plans.

By taking such action, the Commission hoped to: (1) eliminate the costly and inefficient structural separation requirements, so as to encourage telephone companies to make greater use of their network and provide new services to the general public; (2) promote competition in enhanced services by eliminating network barriers (e.g., bundled tariffs) and requiring equal interconnection to the network. The implications of the FCC's Computer III order remain somewhat unclear at this time, however, in light of the district court's recent decision limiting the BOCs' entry into information services, many of which also come under the FCC's definition of enhanced services. (For a further discussion of Computer III, see the section on Information Services)

Another issue which has emerged concerns the potential for jurisdictionally disparate regulation of ONA. Some BOCs are concerned with one Computer III provision which requires that carriers seek waivers if their intrastate tariffs do not comply with certain aspects of the FCC's CEI/ONA requirements. In a recent order, the FCC ruled that the BOCs must continue to file waiver requests where state regulations of their intrastate CEI or ONA activities conflict with its guidelines prohibiting user restrictions.[77]

3. AT&T Consent Decree

Until recently, it generally had been thought that Judge Greene might modify the AT&T Consent Decree to permit the BOCs to provide "information services" through the local network. While his recent decision (September 10) appeared to somewhat ease the information services restriction (generally allowing the BOCs to provide information transmission services to enhanced services providers), it fell far short of the objectives of the BOCs, the Justice Department and many members of Congress to remove the restriction. In March 1988, Judge Greene modified his September decision, allowing the BOCs to provide some information services (i.e., electronic mail and voice storage and retrieval).

At this time, it is uncertain what action, if any, will be taken to overturn the court's decisions. For example, both the September 10th decision and December 3rd ruling (redefinition of "manufacturing") are being appealed by the RHCs. NTIA, meanwhile, has petitioned the FCC to issue a declaratory ruling that pursuant to the Communications Act, the provision of information services by the BOCs is in the public interest. Finally, there has been Congressional activity in support of allowing the BOCs into information services.[78] In the 99th session of Congress, similar legislation received a great deal of support.[79] Many Congressional leaders are concerned that one district court judge has the unwarranted ability to regulate the telecommunications industry through the antitrust laws.

4. BOC/RHC Relationship

Another issue which has emerged out of the AT&T Consent Decree concerns the relationship between the Bell Regional Holding Companies (RHCs) -- created at the time of divestiture -- and their affiliated Bell operating companies (BOCs). Specifically, state regulators are concerned with the RHCs' diversification into areas unrelated to the established expertise (i.e., providing telephone service).

A related concern of state officials is that by investing in unregulated operations, the RHCs might jeopardize the integrity of basic telephone service.[80]

Some state regulators also believe they are not being given adequate access to the RHCs' records so as to monitor transactions between the BOCs and their parent companies.[81] These concerns led the states, through NARUC, to establish Regional Oversight Committees to monitor the RHCs. In addition, regulators in states served by Ameritech's BOCs (Michigan, Wisconsin, Illinois, Indiana, and Ohio) recently announced the formation of a regional committee to coordinate their dealings with the regional holding company.[82]

5. Universal Service

Five years after they were first proposed, access charges continue to remain in the political spotlight. As discussed in the last section, the access charge plan as originally envisioned by the FCC has been greatly revised. As currently proposed, the final dollar amount of the subscriber line charge would be well under the figure originally estimated by the FCC as necessary to ensure full recovery of the interstate allocation of local fixed costs. It is now estimated that the $3.50 charge will recover approximately two-thirds of the interstate allocator.[83]

While the dollar amount of the subscriber line charge has fallen far short of the amount initially proposed by the FCC and presently represents only six percent of the average residential telephone bill, it still remains a concern among lawmakers and consumer groups. For the most part, however, the subscriber line charge has been accepted.

Since divestiture, attention has focused on telephone subscribership levels as a measure of universal service. Many lawmakers and consumer groups warned at the time of divestiture that as local rates increased, consumers would give up their phone service ("drop off the network"). To date, however, the evidence suggests this has not been the case. As noted earlier, despite the local rate increases of the past years, telephone subscribership has increased slightly since divestiture.

Moreover, it now appears that the factor most responsible for individuals not having telephone service is the installation charge and deposit, rather than monthly local service rates, as previously suspected.[84] In Michigan, for example, two-thirds of individuals without telephone service said they could not afford installation charges and deposits, while only one-quarter said they could not afford the monthly bills.[85] A nationwide study sponsored jointly by the Consumer Federation of America, American Association of Retired Persons and AT&T reported similar findings.[86]

In response to these findings, the FCC, as part of its April 1987 order on subscriber line charges, expanded its lifeline program to provide assistance to low-income households for the cost of installation. "Link Up America," as the plan is called, will provide federal assistance for one-half of the cost of residential installation, up to $30.[87] Qualified subscribers will be eligible for this benefit biannually. As noted earlier, twenty-five states and the District of Columbia have been certified under the new plan.

The FCC also has established a monitoring program to measure the effects of its recent changes. The data collected from this monitoring program will be examined by the Federal State/Joint Board in late 1988 and early 1989, prior to implementation of the further increases in the subscriber line charge. Such increases could be delayed or rejected depending on the findings of the monitoring program.

6. Alternative Forms of Regulation

A primary concern of state officials is protecting those ratepayers (particularly residential) with few options for local service. A few states believe the best way to protect residential customers is to prohibit competition to the local exchange companies in markets (intrastate long distance, local business service) whose revenues have been used to subsidize residential service. An increasingly held view, however, is to encourage competition, so long as the local exchange companies are given an opportunity to compete effectively. In the later case, competition is seen as the best means for providing customers with access to new and improved telecommunications services at reasonable rates.

In recent years, numerous states have acted, primarily through the legislative process, to change their telecommunications laws and regulations. Primarily, these reforms have been undertaken in order to allow regulators to keep pace with the rapid technological and competitive changes occurring in the telephone industry. Twenty-two states have adopted legislation authorizing their public service commissions to ease or eliminate regulation on services deemed "competitive."[88]

In addition, an increasing number of states have begun to reexamine rate of return regulation, which has been the cornerstone of telephone industry regulation for more than a century, and is premised on the view that local telephone companies are "natural monopolies." Under this system, telephone companies are permitted to set prices to recover: (a) operating expenses including taxes and depreciation; and (b) some prescribed return on overall capital investment.

Since the early 1960s, rate of return regulation has been criticized by a number of experts for creating undesirable incentives for investment, particularly in technologies which can offer new and improved services; twisting rate structures uneconomically; and failing to ensure adequate incentives to minimize operating costs.[89] These criticisms have drawn greater attention recently in light of increasing competition and rapidly changing technology. At the state level, a number of alternatives have been proposed recently. The one which has received the most attention is called "social contract" regulation. Generally, local exchange rates are fixed, typically at existing levels, and future adjustments are allowed only in accordance with some predetermined formula (e.g., the CPI or some fixed percentage). Prices for all services not subject to the "contract" are deregulated. In July 1987, NTIA examined different alternatives to rate of return regulation and concluded that a modified social contract approach would best serve the public interest.[90] Social contract plans have recently been adopted in Nebraska and Vermont.

A variation of the social contract model now being considered by the FCC for interstate services is the "price cap" approach.[91] With a few exceptions, the proposal would cap existing services for AT&T and the LECs. For these capped services, the FCC proposes a combination of baskets and bands. For the LECs, switched access services would comprise one basket, with special access and interexchange services comprising the other. New services initially would be offered outside of the price cap structure. In addition to baskets, the FCC proposes bands for individual rate elements. These bands would permit carriers to adjust their rates five percent above and below existing levels.

Price caps would be recalculated annually to reflect changes in inflation and exogenous factors (e.g., changes in laws, regulations) less a 3 percent productivity adjustment factor. This productivity adjustment factor is intended to reflect historical productivity of the industry (2.5 percent) plus a .5 percent "consumer dividend," to reflect additional productivity increases attributable to price cap regulation.

Periodic adjustments for individual rate elements would be subject to streamlined review (14 days) so long as they do not exceed the rate bands nor exceed the price cap index for the carrier's basket of services. A number of states currently employ price caps to regulate AT&T's intrastate rates.[82]

Another popular alternative form of regulation is "banded pricing." Under this approach, regulators establish minimum and maximum rates for each service and permit companies to raise or lower rates within each band without prior regulatory approval. Banded pricing has been employed often in the intrastate long distance market as an alternative means of regulating AT&T.[83]

While the focus of rate of return regulation is on controlling profits, alternatives such as banded pricing, social contract and price caps are concerned primarily with price regulation. A variation of the rate of return/profit regulation approach has been labeled "incentive regulation." While regulators would still set a rate of return level for the telephone companies, those companies would be allowed to keep some percentage of any profits in excess of those authorized levels (with the remainder passed through to ratepayers). This approach has been adopted in Wisconsin and New York.

7. Depreciation Reform

As recently as 1985, there was great concern that local exchange carriers would be unable to recover their depreciation reserve deficiency.[84] One suggestion was that carriers should write-off, in whole or part, their unrecovered capital investment against earnings.[85] The industry, however, generally argued that ratepayers should bear the burden for making up the reserve deficiency.[86]

Recent FCC estimates, however, suggest that the depreciation reserve deficiency has declined substantially in the past few years, apparently in response to changes in the FCC's depreciation policies since 1980.[87] Currently, the LEC reserve deficiency is estimated at $13 billion and is expected to decline further, under current procedures, to $5 billion by 1990.[88] Recently, the FCC prescribed a uniform 5-year period for amortizing the reserve deficiency, commencing January 1, 1987.[89]

Major Trends

In the coming years, the local telephone industry should continue to experience much change. Some have suggested that an "intelligent" telephone network is essential for ensuring that all citizens can participate fully in the benefits of the information age. Recently, for example, an independent consumer task force in California recommended that the definition of universal service be expanded to include not only "Plain Old Telephone Service" ("POTS"), but additionally, access to publicly supported information services.[90] In its response to the task force report, Pacific Bell agreed that touch-tone service should be incorporated into any new definition of universal service because it is a "prerequisite to many Intelligent Network services such as interactive audiotex and voicemail."[91]

With respect to local service rates, the prognosis is that rate increases over the next few years will not be of the magnitude recently experienced. In fact, residential local service rates may stabilize or decrease slightly in the coming years. First, the decline in interest rates since 1980 has lowered the actual costs of capital to the local telephone companies. Second, the BOCs have worked to lower their costs since divestiture, reducing their employee base by 11 percent[102] and investing in new technology (e.g., digital switches, fiber optics) which, in the long run, will lower the marginal costs of service.[103] Third, rates may stabilize due to changes occurring in the regulation of local telephone companies. As noted earlier, some states have linked regulatory changes to an agreement that local rates not be increased for some period (usually 3-5 years). Finally, as discussed earlier, changes in the federal corporate tax rate have led some states to lower rates for local service.

In addition to rate stability, the coming years should see an increasing number of states acting to reform their telecommunications laws and regulations. The trend should continue towards permitting greater competition in the local exchange market, both through open entry and streamlined regulation of dominant carriers. For an increasing number of states, telecommunications will be viewed as a means for improving their economic and business climate.

The future also holds the promise of increased diversity and availability of information services to the general public. With the recent decision to allow the BOCs to serve as "gateways" to information service providers, there should be expanded provision of information services to residential customers. Already, two of the RHCs have filed CEI plans with the FCC to provide gateway service on a trial basis.[104]

By the early 1990s, the restrictions may be further eased or eliminated, either in conjunction with the second triennial review by the district court, or perhaps sooner through legislative or judicial action. Thus, in addition to new service offerings from the information service providers, customers may also have the ability to choose additional services provided by the BOCs.

The future should also bring about further technological advancements in the local exchange market. The cornerstone for many of the future changes to occur is being set today with the introduction of out-of-band signaling (also called common channel signaling). It is anticipated that this separate signaling/control network will support an array of new services. (See Appendix).

One of those services which has received a great deal of attention is ISDN, or "Integrated Services Digital Networks." When fully implemented, ISDN is envisioned by the local exchange carriers as providing customers with integrated access to a variety of services through the local telephone company which are presently available only on an individualized basis, and often through separate facilities. With ISDN, customers should be able to send and receive voice and data communications simultaneously over existing telephone lines. ISDN trials have been conducted by the various BOCs for the past two years, with the first commercial offering recently proposed by Illinois Bell.[105] Some advocates of broadband ISDN suggest that its vast capacity, along with further reductions in switching costs, may allow for basic telephone service to be offered at little or no cost.[106]

Critics of ISDN, however, have labeled it as "Innovations Subscribers Don't Need." They contend that the average consumer desires nothing more than "Plain Old Telephone Service" (POTS), yet will be required, nonetheless, to pay for ISDN investment which will benefit primarily large business customers. In addition, it is estimated that ISDN initially will be more expensive to users than POTS. One estimate places the cost to users at 1.7 times the cost of POTS, dropping to 1.2 times POTS by the early 1990s.[107] Finally, critics argue that the full advantages of an integrated digital network (the ability to transmit large volumes of information) will not be realized until the "last mile" of the telephone network has the capacity (with fiber optics) to handle broadband communications. The introduction of broadband ISDN is expected around the year 2000.[108] (For a further discussion of ISDN, see the section entitled "Information Services.")

Researchers at Bell Communications Research are also testing the prototype for a new generation of switches. It is envisioned that these switches, referred to as "digital optical switches," will be able to process information transmitted over fiber optic cable without having to convert the "photonic" (i.e., light) signals into electrical impulses, as is the case today.[109] As such, these switches could allow local exchange carriers to more efficiently switch traffic sent over broadband transmission facilities.

The development of optical switches comes at a time when local exchange carriers are increasing their deployment of fiber optic cable for transmission of traffic. Already, local exchange carriers are installing fiber between their central offices and from those central offices to feeder cables.[110] At least $900 million in fiber optic sales are expected to local exchange carriers in 1987, increasing to $4 billion within a decade.[111] The attractiveness of fiber optics rests both with the expanded capacity it offers in comparison to existing coaxial cable and copper wire, as well as its rapidly diminishing costs. The cost savings associated with fiber will be important where the current costs of installing and maintaining analog local loops make provision of telephone service to certain areas (e.g., rural) prohibitive.[112]

It has been suggested that in the future, fiber optic cable will reach the home for both telephone service and television programming, perhaps over a single integrated facility.[113] Currently, some local exchange carriers plan to test the delivery of services into the home with copper wire, coaxial cable, and fiber.[114] The universal nature of copper wire and its continued functionality suggest, however, that widespread deployment of fiber into the home by local exchange carriers is unlikely in the immediate future. Rather, initial applications of fiber through the early 1990s are most likely to occur in new residential developments. In addition, the pace of local exchange carriers' future involvement in providing fiber into the home for telephone service and television programming may be influenced by what changes, if any, come about in current regulatory policy (e.g., cable/telco cross ownership rules, AT&T Consent Decree).[115]

Fiber is also becoming popular with potential and actual competitors of the LECs. For example, alternative commercial systems are being planned or developed in several metropolitan areas to provide local distribution, including Boston, Chicago, New York, San Francisco and Washington, D.C. Moreover, Merrill Lynch, which owns 97% of Teleport Communications in New York, recently announced the formation of a subsidiary to fund the nationwide development of further metropolitan area networks. These systems provide or plan to provide primarily private line services or interexchange access.[116]

Cable television companies as well are employing fiber optic cable to carry programming from their headends to intermediate distribution points, to interconnect cable systems, and for the provision of high-speed data communications.[117] In the future, the threat of competition from local exchange carriers could result in some effort by cable operators to replace their coaxial cable with fiber into the home as well as upgrade their systems to offer two-way communications. At this stage, however, cable operators (the most notable being ATC, the second largest group owner) are focusing their efforts on the use of fiber optics as the trunking backbone of their systems.[118]

In addition to fiber, microwave should remain an attractive transmission medium, particularly for short-haul, medium-density transmission.[119] With the cost of electronics continuing to fall about 20 percent annually, some reduction in microwave system costs are likely in the near term.[120]

Conclusion

Contrary to the conventional wisdom at the time of the AT&T divestiture, the local exchange market is developing into one of the more dynamic sectors of the telecommunications industry. While the local exchange carriers remain the dominant service providers in the market, there is increasing evidence of competition emerging, particularly for high volume customers. Moreover, dire predictions of large local rate increases causing millions to abandon basic telephone service have turned out to have been unwarranted, as telephone subscribership levels are at their highest levels since the Census Bureau first began collecting data in 1983.

For the future, technological developments (e.g., broadband networks) and increasing competition among service providers hold the promise of creating a telecommunications infrastructure with the capabilities to offer all customers more efficient delivery of existing services, as well as a vast array of new, innovative services.

APPENDIX

New Services Associated With Common Channel Signaling

Enhanced 800 Service - signaling information is routed to a central database (called "Service Control Point" or SCP) containing customer records for validation and determination of the designated carrier. All of the BOCs have committed to offering this service by the end of 1988.

Alternative Billing Service (ABS) - originating customer calling card information is sent to the SCP for validation and determination of the designated carrier.

Enhanced 911 Service - the SCP database is used to direct the emergency calls (along with the address of the caller) to the correct public safety agency. It will also provide instructions and caller-specific medical information.

Custom Local Areas Signalling Service (CLASS) - this service will provide residential customers with various screening capabilities on incoming calls (e.g., distinctive ringing for particular numbers, selecting call forwarding or blocking, automatic repeat dialing, call return, and calling number display) in conjunction with existing custom calling features.

Private Virtual Network (PVN) - allows a customer to implement unique dialing plans and to restrict areas of service by authorization codes or originating station number. PVN is expected to be available in 1990.

Area-Wide Centrex (AWC) - permits the portability of features and a common dialing plan for multi-location Centrex customers. This service is expected to be available by 1991.

Anywhere Call Pickup (ACP) - allows a customer to dial a specific number and be connected to a party calling the office or other designated number.

Source: USTA

Notes

1. The Bell Operating Companies are owned by seven Regional Holding Companies as follows: Ameritech (Illinois Bell, Indiana Bell, Michigan Bell, Ohio Bell, Wisconsin Bell); Bell Atlantic (C&P of DC, C&P of Maryland, C&P of Virginia, C&P of West Virginia, Diamond State Telephone, New Jersey Bell, Bell of Pennsylvania); BellSouth (South Central Bell, Southern Bell); NYNEX (New England Telephone, New York Telephone); Pacific Telesis (Nevada Bell, Pacific Bell); Southwestern Bell (Southwestern Bell); US West (US WEST Communications, formerly Mountain Bell, Northwestern Bell, Pacific Northwest Bell).

2. Fortune, Vol. 118, No. 12, June 6, 1988, at D33.

3. Telephone Statistics, Volume 1, United States Telephone Association, (1987), at 3. [hereinafter 1987 Telephone Statistics].

4. Statistics of Communications Common Carriers (1986), Federal Communications Commission.

   It is estimated, however, that the average residential telephone in the U.S. is used only 24.2 minutes a day: 20.1 minutes for local calls, and 4.1 for long distance calls.

5. Id.

6. With message rate service, the per call charge is untimed.

7. 1987 Telephone Statistics, at 5.

8. Annual Reports of the Bell Regional Holding Companies (Ameritech, Bell Atlantic, BellSouth, NYNEX, Pacific Telesis, Southwestern Bell, US West), 1984, 1986 and 1987.

9. Annual Reports of Fully Subject Carriers Filed With the FCC (Form M), Schedule 34, 1984, 1986 and 1987.

10. GTE Corporation, 1987 Annual Report.

    By comparison, all of the RHCs, with the exception of Bell Atlantic, now publish their Yellow Pages directories through regional subsidiaries, rather than through the operating companies. For 1984, Pacific Bell reported directory revenues of $520.9 million; by 1987, however, revenues had diminished to $2.0 million. Form M, Schedule 34, 1984 and 1987.

11. Id.

12. Id.

13. 1987 Telephone Statistics, at 5.

14. Id., at 17.

15. Annual Reports of the Bell Regional Holding Companies, 1984-87.

16. Id.

17. 1987 Telephone Statistics, at 16.

18. Annual Reports of the Bell Regional Holding Companies, 1984-86.

19. The toll revenue data for the BOCs is representative primarily of intrastate calls, as the BOCs currently are prohibited under the AT&T Consent Decree, with a few exceptions, from providing interstate toll service.

20. Annual Reports of the Regional Bell Operating Companies, 1987.

21. 1987 Telephone Statistics, at 17.

22. Id.

23. "FCC Releases Data on Equal Access Conversions," Federal Communications Commission, Common Carrier Bureau, News Release 2880, May 9, 1988.

24. "Spending Falls Gently in 1988," Telephony, January 18, 1988, Table 2, at 47.

25. Id.

26. Id.

27. Id.

28. Id., Figure 3, at 50.

29. 1987 U.S. Industrial Outlook, U.S. Department of Commerce, p. 31-5.

30. Telephony, January 18, 1988, Figure 1, p. 39.

31. Telephone Subscribership in the United States, Industry Analysis Division, Common Carrier Bureau, Federal Communications Commission, (May 1988).

The Organization for Economic and Cultural Development (OECD) estimates telephone subscribership by counting the number of telephones per 100 people in a given country. Given the proliferation of households with more than one telephone, however, the U.S. and some other developed nations rely instead on the number of households with telephone service. By any standard, the U.S. has one of the highest levels of telephone subscribership in the world.

32. Prior to its compilation of subscribership data every four months as part of the Current Population Survey, the Census Bureau collected data only as part of the decennial census.

33. Id.

34. Summary of State Telephone Rate Cases, Industry Analysis Division, Common Carrier Bureau, Federal Communications Commission, July 22, 1988, at Table 3.

35. Id.

36. Id.

37. Id.

38. Id.

39. Communications Week, August 24, 1987, p. 30.

40. NARUC also supported legislation in the 100th Congress (H.R. 1049) to allow states to determine how excess deferred taxes collected by utilities should be refunded to ratepayers. The 1986 Tax Reform Act currently mandates that those taxes be refunded to ratepayers over the life of the asset (which in some cases, could be 20-30 years).

41. 1985 Telephone Statistics, United States Telephone Association, at 3.; Annual Reports of Fully Subject Carriers Filed With the FCC (Form M), Schedule 60(b), 1984 and 1987.

42. The states are Florida, Georgia, Maine, Missouri, Nebraska, New Jersey, New York, Vermont, and Wisconsin.

43. Trends In Telephone Service, Industry Analysis Division, Common Carrier Bureau, Federal Communications Commission, (August 1, 1988) at Table 6.

44. By comparison, the average residential telephone bill in Canada in 1985 was $32.35 ($24.32 in U.S. dollars), while recent estimates from Japan indicate that telephone bills are approximately $40 per month (in U.S. dollars).

Canada rate information from "Federal-Provincial Task Force Inquiry into Telecommunications Policy," (Mongeau), October 1986, Attachment 1.

45. Primer and Sourcebook on Telephone Price Indexes and Rate Levels, Industry Analysis Division, Common Carrier Bureau, Federal Communications Commission (April 1987).

46. Of course, whether measured service is a lower priced alternative depends upon usage patterns. For those subscribers who make few calls, the fixed monthly cost (i.e., cost of having a "dial tone") of measured service should be lower than flat rate service.

47. These rates do not include federal or state subscriber line charges, which in total average $2.69 cents ($2.60 federal/$0.09 state) per customer. Telephone Rates Update, at Table 3.

48. The Vermont Public Service Board implemented measured service on a trial basis in 1985 and found that nearly 75 percent of customers participating in the trial paid lower bills than they would have under flat rate service. Similar findings have been reported in studies by commissions in Alabama, Illinois, and New York.

Telephone Competition and Deregulation: A Survey of the States, NTIA Report 86-205, NTIS# PB-86248283, (October 1986), p. 29; 1985 Annual Report On Utility and Carrier Regulation, National Association of Regulatory Utility Commissioners, p. 643.

49. One possible explanation for lower rural rates is that calling areas are often smaller in rural areas. As a result, rural subscribers may not be able to reach as many telephones through local calling as their urban counterparts and thus may need to make a greater number of toll calls.

50. States with FCC certified lifeline programs: Arizona, Arkansas, Colorado, Hawaii, Idaho, Maine, Maryland, Minnesota, Missouri, Montana, Nevada, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Texas, Utah, Vermont, Virginia, Washington, and West Virginia. California receives partial federal assistance (waiver of one-half [$1.30] of the federal subscriber line charge) under the FCC's initial lifeline assistance plan. The current plan establishes stricter eligibility criteria to qualify for federal assistance.

51. Report and Order, CC Docket Nos. 78-72 and 80-286, FCC 87-133, (released May 19, 1987).

52. States which have been certified for connection assistance: Alabama, Arizona, Arkansas, Colorado, Connecticut, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Jersey, New Mexico, New York, North Carolina, North

Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Texas, Utah, Virginia, and West Virginia.

53. "First Six Months of Link Up America Produces 13,995 New Telephone Subscribers," FCC News Release 3267, June 6, 1988.

54. Bureau of Labor Statistics, U.S. Department of Labor, Consumer Price Index, (September 1987) at pp. 24-8.

55. The term "settlements" was used only in the context of the Independent telephone companies. Settlements within the Bell System were referred to as "division of revenues."

56. Telecommunications in Transition, Harvard Business School Case Series, No. 384-207 (1984).

57. NTIA Comments to the FCC Federal-State Joint Board, CC Docket 80-286, Appendix B, at p. 11.

58. Relative Cost of Telephone Service: 1940-1983. American Telephone & Telegraph, Economic Analysis Division, April 1983.

59. Congressional Budget Office, The Changing Telephone Industry: Access Charges, Universal Service and Local Rates (June 1984), at p. 13, (hereinafter cited as "CBO, June 1984"); AT&T, Relative Cost of Telephone Service: 1940-1983.

60. Summary of State Telephone Rate Cases, Industry Analysis Division, Common Carrier Bureau, Federal Communications Commission, October 14, 1987.

61. Id.

62. 1984 Annual Reports of NYNEX and Southwestern Bell.

63. Id.

64. Report and Order, CC Docket 20188, 83 F.C.C. 2d 67 (1980), on reconsid., 87 F.C.C. 2d 916 (1981).

65. Notice of Proposed Rulemaking, CC Docket 87-447, FCC 87-313, (released October 5, 1987), at para. 14.

66. Louisiana Public Service Commission v. FCC, 106 S. Ct. 1890 (1986).

67. NTIA Survey of State Telephone Competition and Deregulation, p. 31.

68. *Decision and Order*, CC Docket 80-286, 89 F.C.C. 2d 1 (1982), *reconsid. denied*, 91 F.C.C. 2d 558 (1982), *appeals pending sub nom. MCI* v. *FCC*, D.C. Cir. Nos. 82-1237, 82-1456 (filed March 4, 1982 and April 23, 1982).

69. *Decision and Order, Amendment of Part 67 of the Commission's Rules*, CC Docket 80-286, 96 F.C.C. 2d 781 (1984).

70. *Decision and Order, Amendment of Part 67 of the Commission's Rules*, CC Docket 80-286, FCC 84-637 (1984).

71. Opinion and Order, *Formal Case No. 814, Investigation into the Impact of the AT&T Divestiture and Decisions of the FCC on C&P Telephone Company's Jurisdictional Rates, Order No. 8229*, Public Service Commission of the District of Columbia (1985).

72. *Id*.

73. *United States* v. *Western Electric Co., Inc.*, Slip Op., Civil Action No. 82-0192, (D.D.C., September 10, 1987).

74. *Competition in the Local Exchange Telephone Service Market*, NTIA Report 87-210, GPO# 003-000-00647-6, (February 1987).

75. Under *Computer II*, dominant carriers (e.g., AT&T & BOCs) could offer enhanced services and customer premises equipment (which the Commission classified as nonregulated activities) only through subsidiaries structurally separate from their regulated activities (i.e., basic services). As a result, dominant carriers were prohibited from engaging in joint marketing, planning, or financing of their regulated and nonregulated activities.

76. Upon reconsideration, the FCC ruled that AT&T is not required to unbundle its services under the same criteria as the BOCs, athough it still must file an ONA plan.

    Memorandum Opinion and Order on Reconsideration, CC Docket 85-229, FCC 87-102, (released May 22, 1987).

77. *Memorandum Opinion and Order*, CC Docket 85-229, Phase I, FCC 88-9, adopted January 14, 1988.

78. H.R. 2050 (Swift/Tauke); S. 209 (Gore); H. Con. Res. 339 (Dingell).

79. H.R. 3800, which would have permitted the BOCS to provide information services and manufacture equipment, subject to certain regulatory safeguards, had more than 160 co-sponsors.

80. To date, the RHCs have taken somewhat different approaches to diversification. For example, Southwestern Bell has focused on publishing and mobile systems (e.g., cellular and paging), while NYNEX and Bell Atlantic have focused on office automation (e.g., computers and software). Whatever their business interests, however, the RHCs generally have diversified through acquisitions.

81. Summary Report on the Regional Holding Company Investigations. National Association of Regulatory Utility Commissioners. (September 18, 1986).

82. State Telephone Regulation Report, December 3, 1987, at 1.

83. Prior to 1982, the level of interstate allocation was determined by taking the percentage of time subscriber usage of the network was for interstate calls and weighting that number by a factor of 3.3%. With interstate usage estimated at 7.9% in 1981, the percentage of local costs allocated to interstate service was approximately 26%. Based on current estimates, a subscriber line charge of approximately $3.30-$3.40, would recover all of those allocated costs except those directly associated with interstate usage (now about 9%). The remainder of costs would continue to be charged to long distance carriers (but, of course, ultimately passed through to subscribers through long distance rates).

84. For customers with good credit, the cost of installation and deposit can average $35 dollars for the first month, even if spread out over several months. The charge can be almost two and one-half times higher for customers with credit problems.

85. Low Income Households in the Post-Divestiture Era: A Study of Telephone Subscribership and Use in Michigan, Michigan Divestiture Research Fund & Michigan Citizens Lobby (October 1986).

86. Joint Telecommunications Project, Consumer Federation of America, American Association of Retired Persons, & AT&T, As Presented at the Annual Assembly of the Consumer Federation of America, February 12, 1987.

87. The federal contribution to the states which participate in the FCC's lifeline program (including "Link Up America" comes from a surcharge on interstate telephone usage.

88. Some of the services which have been deregulated/detariffed by legislation or regulatory action in certain states: Billing and Collection, Centrex, Coin Telephone, Inside Wire (New & Maintenance), Mobile Services, Toll (MTS/WATS), Paging, Private Line, Special Access.

89. NTIA Regulatory Alternatives Report, p. 10.

90. NTIA Regulatory Alternatives Report, NTIA Report 87-222, GPO# 003-000-00650-6, (July 1987).

91. Further Notice of Proposed Rulemaking, CC Docket 87-313, FCC 88-172, (released May 23, 1988).

92. Among those states are Arizona, Georgia, Idaho, Michigan, Montana, North Carolina, South Carolina, and Tennessee.

93. Among those states which allow banded pricing for AT&T are Florida, Kansas, Mississippi, Missouri, New Jersey, New York, Texas, Ohio, Nevada, Oregon, and Pennsylvania.

94. AT&T wrote-off its reserve deficiency against its 1983 earnings.

95. See, e.g., Issues in Domestic Telecommunications: Directions for National Policy, NTIA, July 1985, GPO #003-000-00641-7.

96. Laboy, J. Edward, Capital Recovery in the Telecommunications Industry: Issues for the '80s, Program on Information Resources Policy, Center for Information Policy Research, Harvard University, December 1986, P-86-10, at 51.

97. See, e.g., Docket No. 20188, 83 FCC 3d 267 (1980) (Property Depreciation), reconsideration, 87 FCC 2d 916 (1981), Supplemental Opinion and Order, 87 FCC 2d 1112 (1981); Depreciation Rates Order, 96 FCC 2d 257 (1983), recon. denied, FCC 84-505 (released Oct. 31, 1984), aff'd sub nom., Southern Bell Telephone v. FCC, 781 F.2d 209 (D.C. Cir. 1986); Depreciation Rates Order, 99 FCC 2d 1094 (1984).

98. Notice of Proposed Rulemaking, CC Docket 87-447, FCC 87-313 (released October 5, 1987), at 9.

99. Memorandum Opinion and Order, CC Docket 87-447, News Release, January 15, 1988.

100. The Intelligent Network Task Force Report, October 1987.

101. "Pacific Bell's Response To The Intelligent Network Task Force Report," June 1988, p. 12.

102. 1987 Telephone Statistics, United States Telephone Association.

103. For a further discussion of technological advances in the local network, See, Issues In Domestic Telecommunications: Directions for National Policy, NTIA Special Publication 85-16, (July 1985), Chapter II.

104. "Bell Atlantic Files 'Comparably Efficient Interconnection' Plan For Gateway Service, Seeks Expedited Action, Citing Proposed August Service Trial in Pennsylvania," Telecommunications Reports, April 4, 1988, p.1; "BellSouth Telcos Ask FCC to Approve 'CEI' Plan For Proposed Gateway Service," Telecommunications Reports, April 25, 1988, p. 10.

105. "Illinois Bell Has First Local ISDN Centrex," State Telephone Regulation Report, April 7, 1988, p. 1.

106. See e.g., "Yes, A Faster Network, But Which One?" The New York Times, May 22, 1988, p. 9. Comments of Kenneth L. Phillips, Chairman of the Committee of Corporate Telecommunications Users.

107. Remarks of Richard Snelling, Executive Vice President of Networking, Southern Bell, before the ICCC ISDN Conference, as reported in Communications Week, "ISDN Report", October 12, 1987, at 26.

108. "The State Of The Integrated Services Digital Network: Regulation and Implementation in the United States," Michigan Public Service Commission, 1986, p. 77a.

109. Communications Week, January 4, 1988, p. 25.

110. Between 1985-1987, for example, the number of fiber miles installed by the BOCs has tripled (400,000 to 1,200,000).

111. "Bring Fiber Optics Home," Business Week, September 21, 1987, at 34.

112. In addition, with the development of fixed cellular telephone service, it is expected that up to 800,000 rural households currently without telephone service could be added to the public switched network.

113. See e.g., "Telco-Provided Transport Facilities For Broadband Communications," Shooshan & Jackson, October 1987. (Prepared for the United States Telephone Association).

114. Id.

115. NTIA recently issued a report calling for changes in the 1984 Cable Act and FCC rules to facilitate telephone companies' provision of "video dial tone." Video Program Distribution and Cable Television: Current Policy Issues and Recommendations, NTIA Report 88-233 (June 1988).

116. Unlike Teleport Communications in New York, however, Merrill Lynch does not plan to provide uplink and downlink satellite communications services, but rather, concentrate on distribution networks.

"Merrill Lynch Launches Teleport Unit," Communications Week, January 4, 1988, at 35.

117. "The Inevitability of Switched Broadband Transmission To The Home," Shooshan & Jackson, October 1987, at 3. (Prepared for the United States Telephone Association).

118. See e.g., "Pace Quickens For New Gear In Cable TV," Lightwave, March, 1988, pp. 1, 17-18.

119. Huber, Peter, The Geodesic Network: 1987 Report on Competition in the Telephone Industry. U.S. Department of Justice, at 2.14.

120. NTIA Local Exchange Competition Report, February 1987, at 30.

II

Long Distance Network Services

by Phyllis E. Hartsock

Long distance companies serving the United States today offer diverse, sophisticated services at affordable prices. More than any other country in the world, the United States has achieved this result by promoting competition and deregulating long distance services (i.e., toll calling) offered by non-dominant carriers. The long distance market, still used primarily for voice services, has continued to experience significant changes due to new technology, procompetitive Federal and state policies, and the industry restructuring occurring with the 1984 AT&T divestiture.

AT&T, formerly the *de facto* monopoly provider of long distance voice services, faces increasing competition, although it still retains the largest market share among competitors. The advent of competition has meant decreased long distance rates for consumers, as well as a greater abundance of services and different pricing options. Competition has provided a significant incentive for companies to tighten costs and operate more efficiently, while they are also expanding long distance plant in order to meet increased calling needs.

There are important market distinctions in the international and domestic arenas. The benefits of increased competition are most greatly felt in the domestic market, because it is not subject to stringent regulatory conditions on entry as in the international sphere. Competitive entry for international long distance is less open, because companies must first obtain operating agreements from foreign administrations, or PTTs (Postal Telephone and Telegraph organizations), which in many cases have not sought to promote competition as has the United States. Competitive developments internationally has thus generally lagged behind that occurring domestically.

There are also important distinctions within the domestic market, which is divided into serving areas called LATAs (Local Access and Transport Areas) under the AT&T consent decree. There are presently about 164 LATAs, and in some cases, an entire state may constitute one LATA. Depending on whether a toll call is interstate or intrastate, different regulatory bodies exercise some degree of jurisdiction, and in so doing may adopt policies having either a direct or indirect impact on service provision.

InterLATA toll calls may, for example, be interstate and subject to Federal jurisdiction, but they can also be intrastate and subject to state jurisdiction.

IntraLATA toll calls, however, are typically intrastate calls provided by local exchange companies under state jurisdiction. While open entry policies are in effect at the Federal level, many states still restrict entry into the intraLATA toll market, as well as the interLATA (intrastate) market to a lesser extent. As a result, intraLATA toll competition today is less extensive than that in the interLATA arena -- either intrastate or interstate.

Key Industry Statistics

Increase in Number of Long Distance Competitors

AT&T now faces substantial competition from other long distance providers. At year end 1987, there were as many as 540 long distance competitors -- mostly resellers.[1] As indicated below, this competition has produced substantial benefits -- for the ordinary residential customer as well as small and large businesses.

There are a number of competitive facilities-based providers, such as MCI and U.S. Sprint, which are building their own networks and providing both nationwide and international service. Some facilities-based providers, however, may operate only on a regional basis. Facilities-based competition, traditionally a highly capital-intensive venture, has become less so due to declining costs for switching and transmission, and increased ability to lease some portion of network facilities from other providers.

Numerous resellers do not build their own network facilities; rather, they lease other firms' switching and transmission capacity in bulk and resell capacity to their own customers, sometimes adding service features. Entry as a reseller thus requires relatively little capital investment, and it also supports facilities-based competition. Much of the resale revenue is returned to long distance carriers from whom resellers lease facilities.

Private long distance alternatives have also been developing in recent years. The National Telecommunications Network (NTN), for example, is a recently formed consortium of regional fiber optic firms operating a major independent, nationwide network in competition with traditional long-distance carriers.[2]

Despite the tremendous increase in the number of long distance providers, there has also been a trend toward consolidation. For example, Allnet and Lexitel merged in 1985 to form ALC Communications, now the fourth largest facilities-based carrier nationwide.[3] In July, 1986, GTE Corporation and United Telecommunications merged their long distance operations (GTE Sprint and U.S. Tel) to form U.S. Sprint,[4] although United may now buy out GTE's share.[5] Recently Williams Telecommunications Company and LDX Net merged; SouthernNet and Tel/Man merged; and SouthernNet also took over Telecommunications Systems and SouthLand Communications Corporation.[6]

Industry-Wide Revenues

The U.S. domestic long distance market is estimated to produce about $60 billion in gross revenue -- about one-half the $120 billion revenue of the whole U.S. telecommunications industry in 1987. Out of that $60 billion, roughly three-fourths represents interLATA calling, the remainder being intraLATA calls.[7] The total amount of interstate traffic handled by all long distance carriers grew at an annual rate of about 13 percent between 1984 and 1987, with AT&T's traffic growing more slowly than the industry average.[8]

The U.S. international service market is thought to be about $6.9 billion in gross revenue (with approximately half going to foreign administrations). The revenue growth rate was about 15 percent in 1987.[9] The growth for international record services has been modest, however, with international record carrier (IRC) revenues increasing from $272 million in 1975 to $587 million by 1986, but falling 1.2 percent in that year.

Company Revenue and Market Share

At present, the three largest facilities-based competitors are AT&T (with 1987 revenue from message toll service of $22.5 billion),[10] MCI (with 1987 revenues of $3.9 billion),[11] and U.S. Sprint (with 1987 revenues around $3 billion).[12] Precise market shares are greatly disputed, and the numbers will differ depending upon the method of measurement. Market shares may be determined in a variety of ways (i.e., based on revenues, total calling minutes, switched access minutes, or customer accounts). In general, AT&T still has the greatest market share under all measures, although its share generally has been declining over time. This does not necessarily imply that revenues for any particular company are declining, however, because total long distance revenues have grown along with competition in the market.

Noting there is no generally accepted measure of company market shares, the FCC analyzed AT&T's market share in terms of interstate switched minutes. The FCC reported that AT&T's share had declined from over 80 percent in 1984 to 70 percent as of the first quarter of 1988.[13] AT&T's long distance market share is substantially lower when the intraLATA toll market is taken into account, however, since local telephone companies provide most of that service. For example, the Regional Bell Companies' 1986 intraLATA toll revenues were in the $10 billion range.[14] Other local exchange carriers also earn substantial intraLATA toll revenues as a group. As a result, AT&T's share of the interLATA and intraLATA toll markets combined drops into the 60 percent range.

AT&T has long been the dominant provider of voice service internationally, in large part, because many foreign administrations have preferred to deal with just one U.S. provider.[15] The reluctance of foreign administrations initially to allow competitive access has been eroding, and other companies are beginning to make significant inroads in obtaining operating agreements with foreign administrations. Whereas AT&T until quite recently held as much as a 97 percent share of the

TABLE 1
1984 Domestic Market Share[16]

	InterLATA Toll (%)	InterLATA Toll + IntraLATA Toll (%)
AT&T	85.0	63.5
Competitive Carriers	12.7	9.4
Local Exchange Companies	2.3	25.6
Private Microwave		1.5

TABLE 2
Estimated 1987 Domestic Market Share[17]

	InterLATA Toll (%)	InterLATA Toll + IntraLATA Toll (%)
AT&T	72.0	60.0
MCI	10.0	8.0
U.S. Sprint	6.0	4.0
Other	12.0	2.0
Bell and Independent Telephone Companies	*	26.0

* The Bell and Independent Telephone Companies' shares for interLATA toll service are reflected in the "Other" category immediately above.

international long distance switched market,[18] MCI now reports it has a 9 percent share of the international voice market, meaning AT&T's share has in fact begun to decline substantially.[19]

Declining Long Distance Rates

One of the biggest benefits to consumers with the advent of competition has been significant reductions in the price for domestic long distance calling, as follows:[20]

TABLE 3
AT&T Domestic Long Distance Reductions

May 1987	6.4%
Jun 1985	5.6%
Jun 1986	11.8%
Jul 1987	4.8%
Jan 1988	3.5%

Much of the domestic price decline has been attributed to decreased access charges paid by AT&T, with savings passed through to customers, as required by the FCC. It is difficult to ascertain the extent to which price declines may reflect other factors. Along with the decreased long distance prices there has also been an increase in volume of usage. It is likely that such network stimulation occurs when consumers realize calling is less costly. Therefore, the latest price decrease may induce further network usage. Moreover, when AT&T reduces its rates, competitors typically follow suit, attempting to undercut those rates just enough to capture a greater market share. Thus, all long distance customers benefit as AT&T's rates decline.

Price reductions have not been as significant internationally as domestically, but nevertheless have been occurring, perhaps on the order of 10 percent annually.[21] U.S. international telephone service revenues earned by carriers grew from $589 million in 1975 to $2 billion by 1986. Traffic volume grew from 42 million message to 500 million messages over that same period.[22] As in the domestic arena, the trend is to see both rate reductions and increased traffic volumes.

The trend toward decreased prices for interLATA and international calls is not reflected in the intraLATA market. There, prices have tended to remain relatively stable in recent years,[23] although they are beginning to show some decline. This result seems consistent with the lesser degree of competition in that market, as competition is a primary force in driving rates downward.

In fact, the FCC recently reported that in the states' interLATA markets, AT&T's rates were about 16 percent lower when competitive forces were at work.[24] In that report, the FCC also indicated that intraLATA toll rates were about 3-4 percent lower where there is facilities-based competition. It may be that as more states authorize intraLATA toll competition, consumers will see more price reductions there as well.

There are those who argue that long distance price reductions benefit only a limited segment of the population -- those choosing to make such calls. Some feel benefits accrue mostly to businesses with high volume long distance usage. This view may fail to consider the whole picture. Even those who do not generally make long distance calls benefit to the extent others can reach them. Additionally, individuals benefit both as employees of companies and as consumers to the extent that businesses are more likely to operate on a broad geographic scale. For example, many people now enjoy use of 800 (toll free) lines to order goods, engage in financial transactions, or make hotel reservations. Accordingly, the benefits from reduced long distance rates are widespread.

Increased Service Options for Consumers

Greater competition has meant increased service and pricing options, particularly in the domestic arena. For example, AT&T has offered SDN (software-defined network), a service which particularly benefits high volume private line customers by enabling them to use the switched network essentially like a private line. Similar offerings were made by MCI, (Vnet) and U.S. Sprint (VPN). AT&T has also offered Megacom and Megacom-800 (new switched services which are variations of WATS), and Pro America for smaller business users.[25] MCI's Prism I offering, a WATS-type service, was created to compete with AT&T's Megacom service, and Sprint also offered a WATS-type service (UltraWATS).[26]

New private services have been developing as alternatives to traditional long distance service. VSAT networks are being used to link different branches of a business establishment in different geographic locations. Wal-Mart not long ago began fullscale operation of a 1200 node VSAT network, which Wal-Mart referred to as the world's largest two-way, fully integrated private satellite network.[27] VSATs are installed at 1,114 Wal-Mart stores, as well as a number of other office locations used in their operations.

Competition has begun in the 800 market -- estimated to be worth $5 billion and growing 20 percent annually.[28] In the domestic sphere, for example, MCI is providing 800 services, and it had captured a three percent market share by 1987,[29] although it does not have as sophisticated a system as AT&T. U.S Sprint also introduced 800 service in 1987.[30] Internationally AT&T faces some degree of competition from a private entity called Worldwide 800 Services, Inc.[31]

Expansion and Upgrading of Long Distance Plant

Seeking to capture a greater market share in the future, many competitors are expanding or upgrading their networks and installing fiber optic transmission facilities. As of year end 1987, fiber capacity in service by major service providers was as follows:

TABLE 4
InterLATA Fiber-Optic Networks[32]

Company	Route Miles	Fiber Miles
U.S. Sprint	17,000	323,000
AT&T	19,000	456,000
MCI	6,317	223,894
NTN	7,979	156,421
Lightnet	5,300	127,200

This new fiber capacity is significant in ensuring that long distance competition remains robust. While fiber installation may be expensive initially, it is expected to produce lower costs in the long run. The fact that numerous companies are installing so much fiber suggests they do anticipate increased network stimulation justifying this level of capital investment. Once such capacity is built, it will be put to use, even if some companies are not successful and sell their businesses. Others buying such capacity would most likely begin with a new, lower basis, facilitating their operation of a profitable venture.

New service developments and plans for expanded networks have generally resulted in significant capital spending by facilities-based providers. AT&T, for example, announced plans to spend as much as $2.5 billion on digital expansion both in 1988 and 1989.[33] MCI had planned to spend $750 million on its network in 1987, as well as another $300 million by 1990.[34] Such spending suggests not only that the industry is vital and profitable presently, but also that it is expected to remain so in coming years.

Increased Efficiency and Declining Cost Differences for Competitors

Competition has served as a spur to greater marketplace discipline and cost accountability, contributing to lower prices for consumers. There have been extensive cost cutting efforts, including employee layoffs, as companies have sought to operate more efficiently in the competitive marketplace. Despite the cost cutting moves, there appears to be a limit to the extent to which competitors can undercut AT&T's rates -- typically the tactic to date. Whereas cost savings to customers from using a competitive carrier may have initially been 20 to 40 percent less than AT&T's rates, the differential now is more likely to be in the 5 percent to 10 percent range.

Access charges may account for as much as 50 percent of long distance costs. With the declining access cost differential (as equal access is implemented), it is increasingly difficult for competitors to offer huge discounts from AT&T's rates. Actual transmission costs, where scale economies are most feasible, account for roughly 7-10 percent of costs -- providing only a narrow margin in which companies can reflect cost differentials.

Ability to compete effectively therefore is coming to depend largely on marketing skills, quality of service, or provision of special features or options. An example of current day marketing strategy is U.S. Sprint's effort at product differentiation by advertising itself as the "fiber optic" provider of long distance transmission.[35] Whatever the particular tactic, consumers are likely to benefit as companies seek ways to compete with each other to capture more dollars.

Critical Industry Developments

Domestic Regulatory Policies

Competition for AT&T. Until 1959, AT&T was the monopoly provider of U.S. domestic long distance voice services.[36] In that year, however, the FCC opened the door for domestic competition by allocating radio frequencies for private microwave systems.[37] Years later, with the grant of MCI's application to provide long distance services over microwave facilities between Chicago and St. Louis,[38] the FCC actually enabled long distance competition to commence.

The grant of MCI's application caused the FCC to be flooded with some 1700 applications from other entities seeking to offer specialized (i.e., private line) services. To deal with questions common to those applications, the FCC issued its Specialized Common Carrier decision in 1971.[39] The FCC instituted an open entry policy for new carriers in the private line arena to broaden consumer choice, and also to provide incentives for technical and service innovation by AT&T.[40] The FCC later lowered the barriers to entry by authorizing unlimited sharing and resale of private line services, eliminating the need for a large capital investment to compete.[41]

In 1972, the FCC allowed competitive multiple entry into the domestic satellite field under a progressive "open skies" policy.[42] The first domestic satellite system, operated by Western Union Corp, began commercial operations in 1976, increasing the competitive alternatives for private line long distance service. Somewhat later, the FCC gave its approval for a joint venture of IBM, Aetna, and Comsat to operate Satellite Business Systems,[43] later sold to MCI.

At that time, however, the FCC was not prepared to allow competitive entry for switched services, such as MTS (Message Telephone Service) or WATS (Wide Area Telephone Service). The FCC denied MCI's application to provide switched services,[44] but that denial was ultimately overturned by the Court of Appeals.[45] Thereafter, MCI was able to offer its Execunet service, which spawned the offering of other MTS-type services by carriers such as Sprint, SBS, and Allnet. Ultimately, the FCC also permitted unlimited sharing and resale of MTS-like and WATS-like services.[46]

Forbearance from Regulation for AT&T's Competitors. As competition flourished, the FCC questioned the need for full entry, rate, and facilities authorization under Title II of the Communications Act of 1934, believing that market forces could work more effectively to ensure just and reasonable rates for consumers. The FCC commenced its Competitive Carrier proceeding, where it ultimately decided that only AT&T was dominant (i.e., had market power) in the interstate long distance market, and would thus continue to be subject to full Title II regulation under the Act.

Other carriers (such as MCI and Sprint) were found to be non-dominant and were thereafter subject to forbearance from such full Title II regulation.[47] MCI successfully challenged the extent of the FCC's ability to deregulate, however, by obtaining a court holding that the FCC could not prohibit carriers from filing tariffs, although it could permit them not to file them.[48]

The FCC's deregulatory efforts have been highly conducive to competition, although they also fostered an asymmetric market structure. AT&T was and is held to much stricter rules and standards than competitors, ostensibly because of its dominant position — a presumption increasingly subject to debate, due to ever increasing competition.

Payments by Competitors for Local Distribution. With the advent of long distance competition, competitors had won the right to connect their services with the local network for distribution to subscribers. A resulting dispute, which still continues to some extent, was over the appropriate level of compensation competitors should pay to the local operating companies for access. The FCC authorized a payment plan known as ENFIA (Exchange Network Facilities for Interstate Access), set forth in AT&T tariffs.[49] Because competitors typically had lesser quality interconnection than AT&T, ENFIA rates were set at a level below that paid by AT&T for local connection.[50]

With the changing market structure, certain traditional pricing policies were no longer supportable. When AT&T still had a virtual monopoly over both local and long distance services, a system of cross-subsidies came into existence: long distance rates were kept artificially high, so local rates could be kept low. Once AT&T found itself subject to competition in the long distance market, however, continuation of the cross-subsidy became unsustainable. As AT&T sought to compete and to maintain its market share, it desired to lower long distance rates and reduce the subsidy to local loop costs.

The FCC overhauled this traditional cross-subsidy arrangement contemporaneous with the restructuring of the Bell System pursuant to the AT&T consent decree. The FCC's 1983 Access Charge Decision planned a gradual shift in cost burdens, to decrease substantially the long distance subsidy to local loops costs. Under the FCC's plan, there are two types of access charges for use of the local network: (1) that representing fees paid by toll carriers (and presumably passed on to their customers) and (2) the subscriber line charge (SLC) paid directly by the end user.[51]

This payment system began in 1984 for businesses and in 1985 for residential customers, and SLC increases were scheduled for subsequent years. In 1987, the FCC scheduled future increases in the SLC. With each increase in the SLC, there are decreases in the carriers' subsidy to local loop costs, which could be reduced to about eight or nine percent by 1989. With each reduction in the carriers' access charges, the FCC also required AT&T to pass cost savings through to the public,[52] greatly contributing to the long distance price reductions discussed above.

Equal Access for AT&T Competitors. The equal access provisions of the AT&T consent decree have significantly improved the competitive environment for long distance carriers. Under that decree, which divested AT&T of its local service operations, the Bell Companies were required to provide long distance competitors the same quality interconnection afforded AT&T.[53] The decree envisioned conversion of all Bell Operating Company central offices to equal access by September 1, 1986, with the possible exception of those serving 10,000 or fewer lines, or those not equipped with stored-program switches.[54]

Other local exchange companies are also subject to equal access requirements, although such requirements are not identical to those governing the Bell companies. Under a consent decree signed in conjunction with GTE's acquisition of Sprint, GTE is obligated by 1990 to provide equal access in central offices serving more than 10,000 lines.[55] The FCC has required other local exchange carriers to offer equal access to all interstate toll carriers within three years of a "reasonable request."[56]

As of year end 1988, nearly 84 percent of Bell Company lines (81 million network access lines) had been converted to equal access. This meant that subscribers using such lines could choose their primary long distance carrier with easy 1+ dialing, and that competitors had the benefit of interconnections of comparable quality to that provided AT&T.[57] By the end of 1989, it is expected that 94.6 percent of the Bell Companies' lines will have been converted to equal access; and by 1990, 97 percent of their lines.[58] As of year end 1987, about 64 percent of independent company lines were converted, with 74 percent conversion expected by year end 1988.[59]

Selection of a primary long distance carrier, under the FCC's regimen, requires an affirmative choice by subscribers. Companies were required to provide ballots to telephone customers, on a market by market basis, enabling them to select their primary carrier. Some subscribers failed to make such a selection, although they still desired to make long distance calls. An issue therefore arose over distribution of the default traffic for customers failing to return ballots. Originally, any default traffic was automatically assigned to the customer's current carrier. As this was typically AT&T, other carriers contended AT&T received an unfair advantage, skewing competition. The FCC thereafter decided to apportion default traffic among the facilities-based toll carriers on a proportionate basis.[60]

Relaxed Regulation for AT&T. Presently, AT&T is the only interLATA long distance carrier considered dominant and subject to cost-based rate of return regulation, with 12.2 percent the allowable rate of return.[61] AT&T must file tariffs and cost support materials to justify its rates, and the tariffs are subject to critique by competitors as well as the public. Whereas the public is generally concerned about whether rates are too high, competitors sometimes complain that rates are too low, that they are predatory and anticompetitive, and that they are supported by an improper cross-subsidy from other services.

Operating in this increasingly competitive and contentious environment, AT&T contends it must be afforded pricing flexibility. The FCC has instituted measures in response to AT&T's concerns,[62] including issuance of its recent price cap plan. Under that proposal, AT&T would be subject to both a floor and ceiling on prices, with periodic adjustments, but would not be subject to a prescribed rate of return. AT&T would still be required to file tariffs for capped services, subject to streamlined tariff review. There would be a presumably rebuttable presumption of lawfulness if rates met certain price cap parameters.[63] To protect customers in more rural areas, the FCC has proposed that AT&T not be permitted to geographically deaverage its rates.[64]

NTIA has supported the FCC's price cap approach, although it is somewhat different than that suggested in the NTIA Regulatory Alternatives Report (July 1987). The NTIA report stressed the many negative features of rate of return regulation, which leads to goldplating and suffers from a lack of efficiency incentives. After reviewing a number of possible regulatory alternatives, NTIA strongly urged adoption of a modified social contract approach, incorporating price caps for services that are not subject to effective competition.

For services subject to effective competition, NTIA recommended deregulation because marketplace forces render regulatory control of prices unnecessary. The report took the view that AT&T's interstate services, with the possible exception of its 800 service, are now effectively competitive and should thus be deregulated. While NTIA's proposal generally goes beyond that of the FCC, there is agreement that price caps would bring consumers greater benefits than currently exist under rate of return regulation, and also that geographic averaging by AT&T should be maintained.

State Initiatives. Many states have actively considered procompetitive and deregulatory initiatives for toll markets within their respective jurisdictions. As demonstrated in NTIA's 1986 report on Telephone Competition and Deregulation: A Survey of the States, most states permit facilities-based and resale competition for interLATA toll calls, but few are willing to permit intraLATA toll competition.[65] As a result, intraLATA toll service will be slower to receive those benefits of an effectively competitive marketplace now being enjoyed with respect to interLATA services.

Many states have moved away from strict rate of return regulation for long distance carriers in order to provide greater pricing flexibility. Some states have, for example, replaced traditional rate of return regulation with alternatives such as the social contract approach or banded pricing.[66] This trend suggests states will continue to find ways to improve toll service provision within their respective jurisdictions.

Regulatory Policies Affecting International Service

Impact of Domestic Policies. FCC policies spurring long distance competition within the United States have also contributed to the development of competition internationally. With the advent of satellites in telecommunications, and with an increasing number of carriers competing domestically, carriers also sought to capture revenues in the international arena. The FCC has consistently indicated that fostering such competition will provide numerous benefits, such as spurring innovation, promoting efficiency, providing additional service options, and creating downward pressure on rates.

Foreign Monopoly. The international situation is unique because service provision is typically a cooperative venture between entities in two or more countries. Most foreign telecommunications providers are either a government administration directly operating the telecommunications network, or a public corporation operating under authority of the government. Recently, there has been some trend for foreign governments to privatize network operations.

Because of the traditional monopoly situation in other countries, efforts by the United States to open such markets have not always prevailed, causing international competition to lag behind that found domestically. In the last several years, however, the FCC has accomplished substantial procompetitive regulatory reforms in the international arena, although its ability to foster competition there remains limited because some foreign administrations are still reluctant to deal with multiple U.S. carriers.

Historical Voice/Record Dichotomy. Initially, competition in foreign countries was very limited because the United States long maintained a historical dichotomy between voice and record services -- which were provided by different carriers over separate facilities. AT&T had a monopoly with respect to voice services between the states and foreign points, and a small group of IRCs provided U.S. international record services. This dichotomy long continued despite the development of submarine cables capable of carrying both voice and record transmissions. For years AT&T was the sole voice provider, while three IRCs -- ITT World Communications, RCA Global Communications, and Western Union International -- were the primary providers of record services to overseas points.

This historical dichotomy began to seriously erode in 1980, when the FCC allowed some service crossover.[67] The total demise of the dichotomy came with Congress' enactment of the 1981 Record Carrier Competition Act (Pub. L. 97-130, 95 Stat. 1687). Congress instructed the FCC to "promote the development of fully competitive domestic and international markets in the provision of record communications service and facilities (including terminal equipment), the variety and price of which are governed by a fully competitive marketplace." Id.

The FCC also removed various other restrictions that impeded international competition.[68] As a result, full crossover is now allowed: AT&T may provide record services, and the IRCs may provide voice services. Western Union Telegraph, after a long absence from the international market, was permitted to reenter as of 1982.

International Settlements. A factor unique to the provision of international telephone service is the system for dividing revenues between U.S. carriers and their foreign counterparts. With service a joint undertaking, entities at each end must each be compensated. Accounting and settlement procedures were developed to specify the collection rate (the charge collected from the customer), the accounting rate (the amount negotiated by carriers for settlement), and the settlement rate (the rate for converting currencies).

There have been continuing controversies over the ability of foreign administrations to gain an advantage by pitting competing U.S. carriers against each other when negotiating settlements. To prevent this situation, which is referred to as "whipsawing," the FCC instituted a uniform settlements policy. Under that policy, the FCC required identical accounting and settlement terms on the same routes, although waivers were possible.[69] Recently, the FCC reaffirmed the merit of this policy, which it renamed "international settlements." The FCC specified that the policy applies to both indirect and direct routes, as well as both voice and enhanced services. The FCC also established streamlined procedures for reviewing waiver requests.

The FCC modified it settlements rules to ensure that carriers have some flexibility in making route arrangements, but no foreign administration is to be better situated using an indirect route than a direct one.[70] While this policy might seem to inhibit competition because PTTs would have less incentive to grant additional operating agreements, the policy was deemed necessary to prevent U.S. carriers from making concessions that would ultimately be harmful to U.S. ratepayers.

International Satellite Services. Under the Communications Satellite Act of 1962, the FCC has jurisdiction over U.S. participation in both INTELSAT and INMARSAT, which provide global and maritime satellite communications, respectively. The Communications Satellite Corporation (Comsat) was created by Congress as a private entity to be the U.S. Signatory to those two organizations. In coordination with the Departments of State and Commerce, the FCC instructs Comsat as to its participation.

Initially, under the FCC's Authorized User decision, Comsat was treated as a carrier's carrier; it could not provide services directly to the end user.[71] Later, the FCC removed that constraint, enabling Comsat to compete directly with other carriers in providing end-to-end services.[72] That decision was, however, remanded by the U.S. Court of Appeals, finding that the FCC failed to consider certain pertinent issues. Upon remand, the FCC upheld and explained its policy decision, which was then upheld on appeal.[73]

Alternative Satellite Systems. Competition has also been fostered by the decision to allow independent satellite systems to compete with INTELSAT services. In 1983, a number of companies filed applications requesting FCC authority to construct, launch, and operate independent commercial satellite systems. Such systems would provide capacity generally reserved to INTELSAT. Despite much controversy, and disapproval by Comsat, such systems were to be permitted. In 1984, a Presidential determination was made that alternative satellite systems are required in the public interest within the meaning of the Comsat Act.

The FCC then undertook further policy determinations and conditionally accepted some applications.[74] The FCC hoped to stimulate technological innovation and service development, improve network efficiencies, reduce user costs, and create new business and trade opportunities. The application filed by PanAmSat received approval, and the company has begun some preliminary commercial operations, with more extensive coverage expected by year end.

Private Cable Systems. Another significant development resulting from pro-competitive FCC policies was the advent of private cable systems. These systems may serve as alternatives to long distance services provided by the traditional carriers. Recently, the FCC granted the application of Tel-Optik Limited, now called Private TransAtlantic Telecommunications Systems (PTAT) to operate high capacity, fiber optic cables between the United States and the United Kingdom.

PTAT intends to sell or lease capacity directly to users on a non-common carrier basis, setting a unique precedent; previously only common carriers owned such transatlantic cables. The FCC issued a policy statement that operation of private cable systems is in the public interest, because they will increase facilities competition and provide many benefits already enjoyed by domestic users pursuant to the FCC's domestic satellite policies.[75] As a result of the FCC's actions, both intramodal and intermodal competition have been increasing.

Competitive Carrier Policies. As competition has increased, the FCC questioned whether it should continue to apply full Title II regulation to international long distance services. In International Competitive Carrier Policies,[76] the FCC considered the same types of issues previously raised in the domestic sphere. The FCC found that international services consisted of two distinct product markets: International Message Telephone Service (IMTS) and non-IMTS services. The FCC also decided that each country constituted a separate geographic market.

With respect to IMTS, the FCC found that among U.S. carriers, only AT&T was dominant.[77] Other U.S. IMTS providers were considered non-dominant and subject to streamlined regulation (meaning less burdensome tariff review and facilities authorization procedures). All providers of non-IMTS services, with the exception of Comsat,[78] were found to be non-dominant and subject to streamlined regulation. Comsat was still considered dominant with respect to provision of international space segment, multipurpose earth stations, and television service, which would remain subject to full rate-of-return regulation.

As a result of these policies, the situation for international voice service is analogous to that in the domestic arena: while AT&T remains subject to full rate of return and tariff regulation, non-dominant carriers -- its direct competitors -- are subject to less burdensome, streamlined tariff review. Some consideration has recently been given to whether lessened regulation is also appropriate for AT&T internationally. In its price cap rulemaking (discussed above), the FCC is also considering application of this regulatory model to AT&T's international services.

Major Trends and Issues

Deregulation for AT&T

Some fear that today's competitive carriers will prove unable to compete successfully with AT&T over time if current regulatory controls on AT&T are lifted. They contend that with greater pricing flexibility, AT&T could potentially lower its prices to the point that competitors could no longer undercut AT&T's prices, as they have done to date. Some contend AT&T would drive others out of business and totally recapture the market.

AT&T argues, however, that it no longer owns bottleneck facilities, that the long distance market is already highly competitive, and that it is therefore unfair for it to remain handicapped by stricter regulation. Moreover, as significant scale economies occur only for transmission costs -- about ten percent of total costs -- it is highly doubtful that AT&T could recapture the market even if tried.

NTIA has generally supported AT&T's claims that it is time to deregulate competitive services and give AT&T greater pricing flexibility. The issue of decreased regulation for AT&T was addressed both in the NTIA Regulatory Alternatives Report, and by the FCC in its price cap rulemaking. There continues to be much dispute, however, over the existence of effective long distance competition, and whether AT&T's competitors could survive AT&T deregulation. NTIA believes that they would.

Decreased Regulation and More Competition for Access Services

The FCC has proposed application of price caps to the special and switched access services of local exchange companies, a move NTIA supports. Fostering efficiencies and reducing regulatory burdens would lead to lower prices for such services, with both long distance providers and their customers benefitting. Since access charges represent about half of long distance service costs, significant reductions in access charges should produce lower long distance rates.

There is the possibility that as long distance competition grows, alternative access services will develop and spur further price declines for access.[79] Such changes would also contribute to the success of procompetitive policies already at work in the long distance market.

Problems With Equal Access

The process of conversion to equal access has engendered much controversy. Some companies argue that equal access is not really "equal" because they do not have the same technical quality as AT&T, or because they do they have "equal access" on a ubiquitous basis. Some toll competitors maintain they should continue to receive a discount from the rate paid by AT&T for local connection until equal access conversion is completed.

The FCC has generally dismissed petitions or claims attacking equal access implementation on these grounds.[80] Nevertheless, it is likely that such equal access issues will continue to arise in various contexts, as competitors argue that "unequal" access is hindering their ability to compete with AT&T.

Survival in the Long Distance Market

Despite the proliferation of long distance providers, there has been controversy regarding the ability of facilities-based competitors to survive. While some facilities-based carriers were in fact struggling financially at one point, circumstances are now more favorable.

MCI reported losses for 1986 ($448 million), the first deficit in more than ten years,[81] but by the beginning of this year it was turning a profit again. U.S. Sprint was losing $100 million a quarter when it merged with United Telephone, which had reported a $53.7 million loss for the first nine months of 1985.[82] Losses for U.S. Sprint have been narrowing, and there are predictions the company could be profitable by early 1989.[83] While AT&T did not incur such losses, it did take write downs in 1986 which substantially reduced earnings[84] A number of newer players in the field are doing quite well. Lightnet, a fiber optic provider, turned a profit in 1986, and NTN is reported near profitability.[85]

The losses of some long distance providers and the trend toward mergers raises the question whether small firms or new companies without substantial financial backing can be successful as facilities-based providers. Implicit in an effectively competitive market, however, is the risk of failure as well as that of success. Some business failures may be expected to result if market forces are working properly to eliminate ventures which are not efficiently operated, which do not offer desirable services, or which fail for other reasons to meet public needs and wants. Although some entities recently sustained losses, they are now more strongly positioned to be profitable. Accordingly, there is every reason to believe that long distance competitors, large or small, can continue to enter this market and become viable businesses.

It is unlikely that long distance companies will continue to add new capacity at the same rate as the last few years, potentially leading to reduced capital outlays. New network developments -- such as fiber optic transmission -- also ensures that network facilities will be available as a source of competition for AT&T. Were some market failures to occur, other new entrants could be expected to purchase existing facilities. This would provide a new competitive spur for AT&T and other long distance companies. To the extent there is any excess capacity, long distance rates are likely to be driven further downward.

Bell Company Entry into InterLATA and International Markets

There has been much controversy over the AT&T consent decree line of business restrictions, including the ban against provision of interLATA services by the Bell Companies. The 1987 NTIA Trade Report examined the benefits of ending the restriction. The report suggested that Bell Company entry could increase demand for central office switching and transmission equipment, although it might also adversely affect AT&T and other competitors by reducing their market shares.[86]

In undertaking the first triennial review, however, the AT&T consent decree court was unpersuaded by parties' arguments supporting Bell Company entry into interLATA markets, and the court refused to end that restriction.[87] This issue will undoubtedly be further debated, now and during the next triennial review, as the Bell Companies continue their drive to enter long distance markets, particularly in the international arena. NYNEX and PacTel, for example, have both attempted to participate in international telecommunications ventures, but so far they have not persuaded the court to grant the necessary waivers.

Fostering Competitive Entry for International Providers

In the international arena, a primary concern has been the need to convince foreign administrations that open entry is beneficial to the public. Because foreign administrations historically preferred to deal with only one U.S. service provider, AT&T's competitors have often found it difficult to obtain operating agreements. In many cases, those difficulties continue to prevail. Some inroads have been made, however, in moving toward open entry in various countries. More than one carrier is permitted to provide service in a significant number of foreign countries, such as the United Kingdom, France, Belgium, East Germany, Sweden, Japan, Spain and the Republic of South Africa, among others.

Even as such inroads are made, problems may ensue, as with respect to the recent West German initiative to allow competitive carriers to provide international service. The Deutsche Bundespost, the West German telecommunications entity, after extended negotiations with the United States, agreed to open its market to U.S. carriers other than AT&T. U.S. Sprint thereafter obtained an operating agreement from West Germany, but the agreement was conditioned upon U.S. Sprint operating a common gateway which could also be used by other U.S. carriers. When U.S. Sprint filed an application with the FCC for facilities authorization, another carrier opposed the application. Ultimately, a number of different carriers were authorized to serve as gateway providers to the West German market.

While the West German initiative provides an excellent example of continued progress by competing U.S. carriers seeking to gain entry overseas, it also exemplifies the difficulties and delays that are encountered. Given that foreign countries may include various conditions or limitations in their operating agreements, the United States is still faced with the need for measures leading to an environment overseas more conducive to open entry.

Both the FCC and Congress have evidenced concern about these problems. The FCC instituted a proceeding regarding its authority to restrict foreign presence in the United States when reciprocity overseas is lacking.[illegible] The FCC asked for proposals to develop an international model that would represent an ideal for international communications, and that would serve as a benchmark for comparing practices and policies of the United States and other nations. Congress has been considering the problem of limited entry overseas in relation to proposed trade bills, and it has considered whether to give the FCC specific authority to remedy the problem. Because of the sensitive nature of these issues, however, changes may come slowly. This means that the international long distance market is likely to lag behind the domestic one for some time.

Conclusion

Despite the trend toward consolidations and mergers, as well as the occurrence of some financial losses, there will most likely be continued vigorous competition among facilities-based providers and resellers. Considering the investment to date in fiber networks, plans for additional network expansion, and expected long-term decrease in transmission costs, the long distance business continues to be a profitable one attracting many new entrants.

With effective competition the norm, service providers will seek to attract subscribers by lowering rates, offering new services, or providing special features in conjunction with existing services. AT&T can be expected to continue its drive for greater pricing flexibility and reduced regulation. The Bell Companies will undoubtedly continue to press their case for provision of interLATA services.

In this competitive market environment, long distance companies will be forced to keep costs under control. Users will benefit from affordable rates, and perhaps further price reductions, although not likely as great as recently. With long distance charges so affordable, the current trend towards increased calling volumes can be expected to continue.

As equal access implementation nears completion, companies will be competing largely on the basis of marketing strategies and services appealing to niche markets. Marketing efforts will most likely be aimed at the business sector, a more lucrative source for future revenue growth than the residential one.

The degree of toll competition internationally and intrastate is likely to lag behind that in the interLATA toll market. Efforts by the FCC or Congress to promote open entry overseas are more likely to produce gradual changes than an immediate turnaround. The states may vary in their approaches. While 37 of 38 multi-LATA states permit interLATA competition, few permit intraLATA competition, and this may not change significantly in the near term. Where intraLATA toll competition is authorized, moreover, an issue will be the need and potential costs of requiring equal access in that portion of the long distance market.

In conclusion, the data shows that competition has greatly benefitted consumers. A number of facilities-based providers and many resellers are vigorously competing with one another. The prospects are excellent for competition to remain robust, for long distance rates to remain affordable and to decrease further over time, for new service options to appear, and for new entrants to be attracted into the field. While the benefits of competition have been greatest in the interLATA arena, the same trends should spill over to both the international and intraLATA markets.

Notes

1. Summary of Long Distance Carriers, Industry Analysis Division, FCC, June 10, 1988.

2. The NTN consortium was formed in 1985 by Consolidated Net, LDX Net, Litel, Mictrotel, Southern Net, Southerland Fibernet, and Wiltel. Washington Post, August 31, 1987, pp 1, 24.

3. Huber Report, p. 3.4

4. Telephony, Feb. 9, 1987, p. 60.

5. Telecommunications Reports, July 25, 1988, p. 4.

6. 1988 Industrial Outlook, Telecommunications Services, p. 33-4.

7. See NTIA Trade Report (1985), p. 44; Huber Report, (1985), p. 3.5, 9 Communications Industry Report No. 8, (Jan. 1986), p. 14; Fortune, July 20, 1987, p. 106.

8. 1988 Industrial Outlook, Telecommunications Services, p. 33-4.

9. 1988 Industrial Outlook, Telecommunications Services, p. 33-7.

10. Communications Daily, April 8, 1988, p. 1.

11. Business Week, May 16, 1988, p. 39.

12. See Telecommunications Reports, April 26, 1988, p. 8.

13. See "AT&T's Share of the Interstate Switched Market: First Quarter 1988," Industry Analysis Division, Common Carrier Bureau, FCC, June 16, 1988. See Also FCC News Release, Mimeo No. 3429, June 21, 1988.

14. See Competition in the Long Distance Telecommunications Market: An Industry Structure Analysis, by Michael Porter, Monitor Co., Ind., October, 1987, p. 25.

15. This situation developed, in part, because of the former policy establishing a voice/record dichotomy, whereby AT&T was the sole provider of voice services internationally, while other companies provided record services. This service dichotomy was abolished and crossover is now permitted pursuant to the 1981 Record Carrier Competition Act, Pub. L. 97-130, 95 Stat. 1687.

16. This data is from NTIA's report Issues in Domestic Telecommunications: Directions for National Policy, 1985, p. 85. The competitive carrier group included both facilities-based and resale carriers.

17. These estimates have been derived from a number of sources, including 1988 Industrial Outlook, Telecommunications Services, p. 33-4; Telecommunications Reports, July 25, 1988, p. 10; Business Week, May 16, 1988, p.39; The Effect of Competition and Regulation on AT&T's Intrastate Toll Prices, and of Competition on Bell Operating Company IntraLATA Toll Prices, FCC, June 22, 1988; and other articles cited in this paper.

18. 1988 Industrial Outlook, Telecommunications Services, p. 33-8.

19. Telecommunications Reports, July 25, 1988, p. 10.

20. See Wall Street Journal, Aug. 6, 1987; FCC News, July 1, 1987; and Telecommunications Reports, January 11, 1988, p.3. See also Trends in Telephone Service, Common Carrier Bureau, FCC, August 1, 1988, pp. 4 and 6.

21. There was a 10.1% decline in rates reported for 1986. 1987 Industrial Outlook, Telecommunications Services, p. 31-8.

22. See Telecommunications Reports, December 28, 1987, p. 27.

23. Trends in Telephone Service, Industry Analysis Division, Common Carrier Bureau, FCC, August 1, 1987, p. 6.

24. The Effect of Competition and Regulation on AT&T's Intrastate Toll Prices, and of Competition on Bell Operating Company IntraLATA Toll Prices, Industry Analysis Division, CCB, FCC, June 22, 1988, p. 1.

25. Pro America is an optional calling plan which offers a volume discount targeted to customers whose monthly bills approach the $200 range.

26. See 1987 Industrial Outlook, Telecommunications Services, p. 31-8; Washington Analysis Corporation Investment Advisory, July 1, 1987, p. 5.

27. See Communications Daily, January 13, 1987, p. 5.

28. Telecommunications Reports, July 25, 1988, p. 10.

29. Telecommunications Reports, July 25, 1988, p. 10.

30. 1988 Industrial Outlook, Telecommunications Services, p. 33-7.

31. Telecommunications Reports, April 13, 87, p. 23.

32. Fiber Deployment Update, Year-end 1987, Industry Analysis Division, Common Carrier Bureau, FCC, January, 1988.

33. 1988 Industrial Outlook, Telecommunications Services, p. 33-4.

34. Fortune, July 20, 1987, p. 106.

35. Id. at 93.

36. Western Union was the monopoly provider of domestic telegraph and telex services in the United States, while a small group of IRCs (WUI, RCA Globcom, ITT, FTCC and TRT) provided such record services internationally.

37. Allocation of Frequencies in the Bands above 890 Mc., 27 FCC 359 (1959), 29 FCC 825 (1960).

38. MCI Communications, Inc., 18 FCC 2d 953 (1969), 21 FCC 2d 190 (1970)

39. Specialized Common Carrier Decision, 29 FCC 2d 870 (1971), reconsideration denied, 44 FCC 2d 467 (1973), aff'd sub nom. Washington Utilities & Transportation Commission v. FCC, 513 F. 2d 1142 (9th Cir. 1975), cert. denied, 423 U.S. 836. See generally Interstate Telecommunications Competition After Execunet, 31 Fed. Com. L.J. 117 (1978).

40. Id., 29 FCC 2d at 910.

41. Resale and Shared Use of Common Carrier Services and Facilities, 60 FCC 2d 261 (1976), recon. 62 FCC 2d 588 (1977), aff'd sub nom. AT&T v. FCC, 572 F. 2d 17 (1978), cert. denied, 439 U.S. 875 (1978). See also Resale and Sharing of Private Line Communications Services: AT&T Restrictions and FCC Regulation, 61 Va. L. Rev. 679 (1975).

42. Domestic Communications-Satellite Facilities, 35 FCC 2d 844, recon. 38 FCC 2d 665 (1972).

43. Satellite Business Systems, 62 FCC 2d 997 (1977), 64 FCC 2d 872 (1978), aff'd sub nom. U.S. v. FCC, 652 F. 2d 72 (D.C. Cir. 1979) (en banc).

44. MCI Telecommunications v. FCC, Docket No. 20640, FCC 76-622, released July 13, 1976.

45. MCI Telecommunications Corp. v. FCC, 561 F. 2d 365 (D.C. Cir. 1978), cert. denied, 434 U.S. 1040 (1978); and MCI Telecommunications Corp. v. FCC, 580 F. 2d 590 (D.C. Cir. 1978), cert. denied, 439 U.S. 980 (1979). See also Competition in Intercity Telecommunications After Execunet, 31 Fed. Comm. L.J. 117 (1978).

46. Resale and Shared Use of Common Carrier Domestic Public Switched Network Services, 83 FCC 2d 167 (1980).

47. Policy and Rules Concerning Rates for Competitive Carrier Services and Facilities Authorization Therefor, CC Docket No. 79-252, 85 FCC 2d 1 (1980); 91 FCC 2d 59 (1982); 48 Fed. Reg. 46791 (Oct. 14, 1983); 95 FCC 2d 554 (1983); 98 FCC 2d 1191 (1984); 99 FCC 2d 1020 (1985), rev'd and remanded sub nom. MCI Telecommunications Corp. v. FCC, 765 F. 2d 1186 (D.C. Cir. 1985).

48. Competitive Carrier, 6th Report and Order, 99 FCC 2d 1020 (1985), rev'd and remanded sub nom. MCI Telecommunications Corp. v. FCC, 765 F. 2d 1186 (D.C. Cir. 1985).

49. See Exchange Network Facilities, 71 FCC 2d 440 (1979), extended 90 FCC 2d 6 (1982).

50. Id.

51. MTS and WATS Market Structure, CC Docket No. 78-72 Phase I, 93 FCC 2d 241; modified on recon., 48 Fed. Reg. 42,987 (Sept. 21, 1983); modified on further recon., 97 FCC 2d 682 (1983); modified on further recon., 97 FCC 2d 834 (1984), aff'd in pertinent part sub nom. National Ass'n of Regulatory Util. Comm'rs v. FCC, 737 F.2d 1095 (D.C. Cir. 1984), cert. denied, 469 U.S. 1227 (1985); modified on further recon. 99 FCC 2d 708 (1984), appeal pending sub nom. Am. Tel. and Tel. Co. v. FCC, No. 84-1148 (D.C. Cir.), modified on further recon., 101 FCC 2d 1222 (1985), aff'd on further recon., 102 FCC 2d 849 (1985).

52. See for example, FCC News July 1, 1987, regarding AT&T's recent 4.8% decrease in prices.

53. U.S. v. AT&T Co., 552 F. Supp. 131 (D.D.C. 1982), aff'd sub nom. Maryland v. U.S., 460 U.S. 1001 (1983).

54. Id.

55. United States v. GTE Corp., 1985-1 Trade Cas. (CCH) Para 66,355 at p. 64,778 (D.D.C. 1984).

56. Independent Company Access, CC Docket No. 78-72, Phase III, 100 FCC 2d 860 (1985).

57. FCC News, "FCC Releases Data on Equal Access Conversions," Mimeo No. 118, October 9, 1987.

58. See FCC News, "FCC Releases Data on Equal Access Conversions," Mimeo No. 2888, May 9, 1988.

59. Trends in Telephone Service, Common Carrier Bureau, FCC, August 1, 1988, p. 11.

60. Investigation of Access and Divestiture Related Tariffs, 101 FCC 2d 911 (1985).

61. In the Matter of Authorized Rates of Return for the Interstate Services of AT&T Communications, CC Docket No. 84-800 (Phase III), FCC 86-354, released August 25, 1986. Other long distance carriers were also subject to such regulation before the FCC's Competitive Carrier proceedings provided for deregulation of non-dominant carriers. For a discussion of the regulatory history of rate-of-return regulation, see NTIA Regulatory Alternatives Report, July 1987.

62. MTS service can be offered under an optional calling plan with volume discounts if there is a net increase in revenues for switched services. Guidelines for Dominant Carriers' MTS Rates and Rate Structure Plans, CC Docket No. 84-1235, FCC 85-540, 50 Fed. Reg. 42,945 (Oct. 23, 1985). Also, certain volume discounts are not subject to specific cost standards, as long as they meet certain other criteria. Private Line Rate Structure and Volume Discount Practices, 97 FCC 2d 923 (1984).

63. In the Matter of Policy and Rules Concerning Rates for Dominant Carriers, CC Docket No. 87-313, FCC 88-172, released May 23, 1988. The FCC also proposes to apply price caps to interstate access services of local exchange carriers.

64. Presently, AT&T's domestic long distance rates are averaged nationwide. Many believe such averaging has been particularly beneficial to rural areas which might otherwise be subject to higher long distance charges. If deaveraging were allowed, long distance charges might be affected by varying cost factors in different geographic areas.

65. See NTIA's Report, pp. 6-16.

66. Id. at 9-11. Among states using banded pricing are Arizona, Florida, Mississippi, and Ohio. Vermont, Nebraska, and Illinois have been prominent in forging a social contract approach. Many other states also provide carriers with some form of pricing flexibility, which may be a variations of the other approaches. See e.g., State Telephone Regulation Reports, June 16, 1987.

67. With the Dataphone, and Datel orders, the FCC partially removed the voice/record dichotomy, allowing AT&T to offer data services and the IRCs voice services under limited conditions. See AT&T, 75 FCC 2d 682 (1980) and WUI, 76 FCC 2d 166 (1980), respectively.

68. See e.g., International Carriers - Gateway Expansion, 76 FCC 2d 115 (1980) and International Telex Interconnection/Unbundling, 76 FCC 2d 61 (1980); both aff'd sub nom. Western Union Teleg. Co v. FCC, 665 F.2d 1126 (D.C. Cir. 1981).

69. See Uniform Settlement Rates, 84 FCC 2d 121 (1980); and FCC 85-332, released July 3, 1985.

70. See FCC News, Mimeo No. 1935, released February 17, 1987.

71. See Proposed Modifications of the Commission's Authorized User Policy Concerning Access to International Satellite Services of Comsat, 90 FCC 2d 1394 (1982), revising Authorized Users and Entities, 4 FCC 2d 421 (1966).

72. See FCC 84-633, released January 11, 1985.

73. See Authorized User on Remand, 100 FCC 2d 177 (1985), aff'd Western Union International, Inc., 61 P&F 2d 954 (D.C. Cir. 1986).

74. See Establishment of Satellite Systems Providing International Communications, 101 FCC 2d 1046 (1985), recon. denied, 61 P&F 2d 649 (1986).

75. Tel-Optik, Limited, 100 FCC 2d 1033 (1985).

76. CC Docket No. 85-107, 102 FCC 2d 812 (1985); recon. denied, FCC 86-339 (released August 7, 1986).

77. The FCC also considers dominant for IMTS any foreign owned or controlled providers. IMTS is the international equivalent of domestically provided MTS.

78. Comsat provides five distinct categories of service: space segment services, multipurpose earth station services, television service, IBS (INTELSAT Business Services), and end-to-end services.

79 .For example, some groups of independent telephone exchange companies (i.e., Iowa Switch), have joined to provide access services to long distance carriers, but it is not clear how widespread such ventures will be.

80. Investigation Into the Quality of Equal Access Services, RM-5196, FCC 86-248, released 5/23/86. TDX had complained of problems with access, contending the same difficulties were not encountered with respect to access afforded AT&T.

81. Fortune, July 20, 1987, p. 106; Business Week, May 25, 1987, p. 114.

82. Telephony, February 9, 1987, p. 60.

83. See Wall Street Journal, November 19, 1987 and January 4, 1988.

84. Wall Street Journal, August 25, 1987, p. 39; Washington Post Business Section, October 26, 1987, p. 3. AT&T took a $3.2 billion write down in 1986.

85. Washington Post, August 31, 1987, p. 24.

86. See pages 103-4.

87. U.S. v. Western Electric Co., slip opinion, Civil Action No. 82-0192 (D.D.C. September 10, 1987).

88 .In the Matter of International Policies and International Telecommunications, CC Docket No. 86-494, Notice of Inquiry and Proposed Rulemaking, FCC 86-563, released January 30, 1987.

III

Fiber Optics

by NTIA Staff

Over the past two decades, the technology of fiber optics has emerged as a highly practical and cost-efficient communications medium, capable of offering very large transmission capacity, while delivering other advantages as well.[1] In Japan and Western Europe, as well as in the United States, fiber optics has become competitive with, and has often displaced other communications media as the technology of choice in numerous applications. Research and development efforts, aimed at improving the cost-performance characteristics of this technology, hold great promise for increasing the suitability of this medium for still more applications. As a result, a dynamic transnational industry which manufactures fiber, necessary optical and electronic devices, and related hardware, has grown rapidly in response to these opportunities.

Since voice, data, and video signals are transmitted optically by short bursts of light through glass filaments, the fiber optic medium differs fundamentally from many other media which rely on electrical transmission of signals. The basic elements of an optical fiber transmission system include a transmission path, consisting of one or more fibers[2], housed in a protective cable, and devices for converting electrical signals into optical signals and vice versa. Additional elements may include repeaters to regenerate signals over large transmission distances and multiplexers to increase the capacity of individual fibers. Optical fiber transmission systems are often joined with switching facilities to build high-capacity switched networks.

Fiber optic transmission facilities can offer immense bandwidth by comparison with its antecedents. Optical systems of the late 1970s were capable of transmitting at the rate of 45 megabits per second (Mbps) (accommodating 672 voice channels per fiber), almost 30 times the capacity of standard copper plant. Present systems routinely operate at 565 Mbps, accommodating 8064 voice channels. While new commercially-available systems will transmit at 1.7 billion or gigabits per second (Gbps), research laboratory reports anticipate facilities capable of transmitting trillions of bits per second.

Demand for Fiber Optic Facilities[3]

The very large capacity, low attenuation, and small size and weight, taken together with other characteristics of optical transmission systems make this medium particularly attractive for certain applications. Markets are not only well developed within Japan, Western Europe, and the United States. Plans are underway to operate numerous transoceanic fiber optic cable links throughout the Atlantic, Pacific, and Caribbean regions. Even with the rapid growth of fiber optic transmission capacity during this decade, it is worth noting that there will continue to be viable markets for copper-based, satellite and microwave transmission facilities. Thus, both public and private networks in the near term are likely to contain a mix of optical fiber and other transmission media.

The Domestic Market. The dramatic growth in the U.S. fiber optic market during the 1980s resulted in large part from the high rate of installation by long-haul and long distance carriers. Realizing that fiber optic technology was well suited to the need to expand capacity linking carriers' switches, these companies embarked on very large new facilities expansion programs. According to the Federal Communications Commission, approximately 64,000 route miles of fiber were installed by interexchange carriers by the end of 1987, compared to over 34,000 route miles completed in 1986. With these networks largely operational before the end of the decade, some analysts have projected slower future growth in this market segment.

The major interexchange and regional carriers have indeed been involved in major fiber optic building programs. AT&T has begun to install gigabit transmission systems in its network. The company's 1.7 Gbps system, able to carry 24,000 calls simultaneously, is being installed on AT&T routes connecting several cities. Multiplexers will be used to further increase the transmission capacity of AT&T's network.

By 1983, MCI was installing substantial quantities of optical fiber in its network. Since that time MCI has developed high capacity systems, including an 810 Mbps system in New York state and a 1.13 Gbps fiber optic link between New York City and New Jersey. The MCI network is expected to have approximately 19,000 route miles of digital microwave and fiber optic transmission capacity by the end of this year.

U.S. Sprint has planned a $ 2 billion fiber network encompassing 23,000 miles. By late 1987, U.S. Sprint was carrying traffic along the 17,000 miles of its operational network. Additional construction was begun in late 1987 on two coast-to-coast routes. A third route will run from New York to Seattle. The company expects that 95 percent of its traffic will be on fiber by the end of 1988.

The National Telecommunications Network (NTN), a consortium now consisting of five regional telecommunications companies (Williams Telecommunications, Southernet, Litel, Microtel, and Consolidated Network), has completed its planned 10,500-mile digital network, with members investing a total of $1 billion.

Lightnet, a 5,000 mile network laid primarily along CSX railroad right-of-way covering the eastern United States, has completed its backbone network serving the Chicago-Atlanta route. Lightnet is jointly owned by CSX Corporation and Southern New England Telephone Company.

Norlight, a regional network in the Midwest, has planned a 650-mile fiber network, costing $33 million. The network is a joint venture of five public utilities in Wisconsin, Illinois and Minnesota. Norlight will interconnect with NTN to gain access to a national network.

Clearly, the fiber optic building activities of the interexchange and regional carriers have caused a substantial demand for optical fiber and related hardware. Although fiber optic facilities have become the preferred transmission medium for most high-density and long-distance applications, the widespread use of fiber in the subscriber loop has not yet occurred in the United States. While local telephone companies have used fiber optic systems for interoffice trunking connections, many such companies see insufficient demand for more transmission bandwidth by residential customers to warrant installation of fiber optic equipment into the home. In service areas experiencing population growth, some telephone companies, while not installing fiber optic facilities directly to the home, have opted to deploy optical fiber systems in feeder plant.[4]

Since the high-capacity feature of optical fiber offers little advantage where traffic and future growth are low and the remote sites are dispersed, some companies (e.g., Pacific Bell) have chosen not to abandon their substantial capital investment in copper-based systems. By contrast, others (e.g., BellSouth) have emphasized development of fiber in the local loop as quickly as possible. Southern Bell is experiencing a 50 percent growth in digital-loop carrier (DLC), half of which is being placed on optical-fiber feeder plant. Ameritech placed over 80,000 fiber miles into service during 1986. By 1990, Ameritech is scheduled to have over 260,000 miles of optical-fiber cable installed throughout its service area to replace existing copper wire.

The existence of alternative technologies may, in some instances, inhibit the rapid deployment of fiber in residential and small business market segments. The potential advent of video dial-tone, the emergence of new enhanced services, as well as the demand for high-definition television, potentially to be delivered by telephone companies, however, may well change the character of customer demand for transmission bandwidth and make further development of fiber optic facilities in the local loop even more attractive.

As demand for optical fiber and cable by long distance telecommunications networks has leveled off in the United States, the larger manufacturers have begun placing more emphasis on developing optical fiber systems for subscriber loop and military uses.[5] The United States government is planning to spend up to $2 billion on fiber optics by 1990, the vast majority of which will be allocated to military systems. Spending for military optical fiber-based telecommunications networks is expected to average about $150 million a year.

Military applications such as weapons testing, tactical voice and data communications, video communications, and radar remote telemetry require rugged fiber optic cable. Leading manufacturers have developed several designs for these applications, including cables that provide the necessary anti-buckling elements, temperature stability and mechanical ruggedness. Research by both government and civilian organizations continues to refine technologies for these applications.

The particular advantages of fiber optic systems for military applications are apparent. Underground nuclear experiments have deployed fiber optic cables as substitutes for heavy coaxial cable to connect sensors to remote monitoring stations. Several fiber optic cable designs support tactical, field deployed voice and data communications systems. Night-vision devices incorporating fiber optics (e.g., night goggles, tank vision systems, tank periscopes, long-range observation tubes, and gun sights) will account for $1 billion over the next five years. Fiber optic cables will also be used for land-based weapons systems.

Sea and space-based applications are also being developed. Last year, the Navy allocated an additional $9 million for its Adrianne telemetry system which will use fiber links to connect acoustic hydrophone arrays to shore detectors for submarine monitoring work. NASA has developed a Broadband Analog Fiber Optics System test bed, associated with the U.S. Space Station project.

Foreign Markets. The installation of fiber optic facilities in Japan largely mirrors the U.S. market in terms of timing and applications. A 7,000-km NTT backbone network was completed in 1985 before Japanese demand for fiber optics leveled. As fiber optic technology develops in local loop plant, however, the Japanese market will grow. Statistics compiled by the Japanese Optoelectronic Industry and Technology Association, (OITDA), reveal a marked increase in the use of multimode fiber, most of which will be used in the local loop.[6]

The privatization of NTT has stimulated telecommunications competition in Japan. Although NTT remains the largest consumer of fiber optics, new common carrier networks will use fiber optics in their networks, including Daini-Denden, Japan Telecom, Teleway Japan. In addition, nine regional electrical public power utilities have joined together under the direction of the Ministry of International Trade and Industry (MITI) to form a nationwide fiber optic network. These new companies will use fiber optic systems in both local loop and intercity applications, along railway lines, highways, and along utility rights-of-way.

While the European fiber optics market will reach $1.5 billion in 1991, roughly five times the 1985 level, developments in individual countries differ widely. The United Kingdom has completed its backbone network and plans to develop fiber optic systems in local loop plant. Germany and France are embarking on inter-city fiber optic networks, interconnecting urban networks.

Intercontinental communications has been a vital concern since international telegraphy via undersea cables made such communications possible during the nineteenth century. With the advent of the first cable capable of carrying voice, TAT-1 (Transatlantic Telephone Cable Number l) commissioned with 36 voice channels in 1956, the drive was on to develop more transmission capacity with better signal quality. By 1965, half of the 4200 worldwide circuits were intercontinental circuits across the Atlantic and Pacific Oceans. TAT-7, with 4200 voice channels, was commissioned in 1984 as the world's first transatlantic fiber optic cable system. With this new cable, the total capacity across the Atlantic will be quadrupled to a total of 38,500 voice channels.

The numerous advantages of fiber optic over copper cables are no less applicable here. Compared to satellite systems, fiber-optic cable systems are often superior. While the life span of a satellite is seven years, cables can operate for more than twenty years. Satellites require ground tracking, telemetry and control facilities, while fiber optic cables are permanently placed and require less monitoring. While satellites are vulnerable to natural and man-made hazards, fiber cables are immune to electrical storms, radio sefrequency interferences and electromagnetic explosions. For two-way voice and data communications, fiber cables have a much greater degree of clarity and instant response, while satellites are subject to time-delay and echo problems.

The International Trade Administration of the U.S. Department of Commerce suggests that unless unforeseen obstacles arise, fiber optic cables will be crossing the Atlantic, Pacific and the Mediterranean, dramatically increasing current capacity and possibly shifting traffic to underseas systems at the expense of satellites. Based upon this forecast, 360,000 voice circuits will be available for use, compared to just 23,000 now. Similarly, in the Pacific, 5,100 voice circuits will increase to 118,500 circuits.

Suppliers of Fiber Optic Technology

With the development of markets in the United States, Japan, and Western Europe, a number of dominant companies have emerged as competitors in these countries.

United States Suppliers. Although more than 800 companies in the United States are involved in fiber optic system component production, the domestic market is dominated by a handful of major companies. AT&T and Corning, for example, together account for 75 percent of the U.S. production of actual optical fiber. Siecor and AT&T account for a similar share in the fiber optic cable market. AT&T and Rockwell-Collins are considered industry leaders in primary component hardware, with the Japanese firms, NEC and Fujitsu, playing a very active role in the U.S. market. Sales of related hardware are much more diverse with nine firms including AT&T, AMP, Dorran/3M, OFTI and Amphenol leading the market.[7]

The following discussion briefly sketches the activities of some of the larger manufacturers. AT&T is one of few integrated producers of fiber optic systems and components. It is also one of the largest users of fiber optic hardware in the United States. AT&T has several plants which produce glass fiber, cable, and related hardware. Annual production at its Norcross fiber manufacturing plant amounted to 800,000 fiber-km in 1986. The plant manufactures single-mode and multi-mode fiber as well as fiber for special applications (e.g., undersea, military) and also produces the finished fiber optic cable product. AT&T also manufactures related hardware at its Norcross plant as well as at its Allentown plant. Lightwave transmission systems are produced at its Andover plant.

Corning Glass Works (CGW) has roughly the same fiber manufacturing capacity as AT&T. In addition to its shared interest in Siecor, Corning has bought ownership interests in: (1) Plesscor (now called PCO), a producer of optoelectronic components; (2) Raycom Systems, a firm specializing in the design and manufacture of fiber optic local data communications products; and in (3) MetriCor, a maker of fiber optic sensors for monitoring blood gasses and temperature. In addition, Corning has control of over 250 patents in fiber optics, some of which are due to expire over the next few years.

Siecor Corporation, a joint venture between Siemens (West Germany) and Corning, is one of the two largest producers of fiber optic cable in the United States, accounting for about 30 percent of the market. Siecor produces fiber optic cable for long-haul networks, as well as for subscriber loop, data communications, and military applications. Siecor also produces fiber optic components, including splicing equipment, transmitters, and receivers. Its joint venture with Bell South, FIBERLAN, helps business users and consumers to plan and operate fiber optic local area networks.

Alcatel NA, formed by the merger of ITT and Alcatel (France) in 1986, consolidated the fiber optic operations of both companies in the United States. ITT's Roanoke fiber plant has been joined with the fiber optic cable plant operated by Celwave, a company bought by Alcatel in 1985. The annual output capacity of Alcatel is about 250,000 fiber-km. of fiber optic cable.

Several other companies are also worth mentioning. Spectran, a producer of optical fiber for special applications, beset in recent years by financial and other problems, focuses on the military and medical markets, concentrating its efforts on radiation-hardened fiber, fluoride fiber, and an all-silica fiber designed for hazardous environments. Last fall, the company filed a U.S. patent application for an all-ceramic coating, which enhances the strength and optical properties of fiber. At present, Rockwell-Collins is a major supplier of high-capacity fiber optic transmission systems and also produces digital multiplexing equipment.

Other Suppliers. Japanese production capacity of optical fiber has been estimated to be about 550,000 fiber-km per year. Thus, Japan ranks as the second largest producer country in the world, behind the United States. Japanese industry statistics indicate that industry output for fiber optic cable continues to rise, at an average rate of 24 percent yearly.

Three Japanese fiber companies, Sumitomo, Furukawa, and Fujikura, dominate the domestic market, with a combined market share of about 75 percent. The market shares of Hitachi Cable (9.6 percent) and Showa (4.3 percent), relative newcomers to the market, continue to rise.

Japanese fiber optic firms have begun to look overseas to exploit their production capacity. Their investments in the United States are intended to enter the world's largest market. The threat of patent infringement litigation and Congressional concern over the international trade situation have added incentives for firms to locate in the United States.

Sumotomo, Fujikura and Furukawa are also developing new markets in the Middle East and Far East through licensing arrangements, joint ventures and direct orders. Sumitomo, for example, has established joint ventures in optical fibers manufacturing in Spain and Australia, and has licensing arrangements in Korea and Germany. Fujikura has entered the Chinese optical fiber market through a joint venture with Xian Cavle Works.

Critical Research Developments

Alexander Graham Bell's invention of the "photophone" in 1880 has been cited as the beginning of optical communications.[8] In addition, 19th Century work by John Tyndall on refraction and reflection, and by Charles Vernon Boys on drawing of glass fibers, are also important precursors to the development of fiber optics.

It was not until 1966, in a landmark paper by K.C. Kao and G.A. Hockham, that fiber optics become a reality. In their article in Proceedings of the IEE, Kao and Hockham argued that communications over a glass optical fiber would be practical if attenuation losses (a measure of the loss in electrical strength encountered by the signals sent through a cable) could be reduced to 20 dB per kilometer.

By 1970, Corning announced the production of a fiber that had broken the 20 dB barrier. Continuing research and development efforts on the medium have emphasized the creation of improved fibers and the refinement of manufacturing processes, to reduce the attenuation rate of silica fibers to their theoretical limit of 0.15 dB/km. These developments and others have made fiber optic communications systems highly practical and cost-efficient technologies for a wide range of applications.

Over the last two decades, very important research and development work has attempted to increase the transmission capacity of individual fibers and increase the distances which signals can travel without need for regeneration. Particular work has focused on improvement of optical sources and detectors, multiplexers, and low-loss connectors and splicers.

New multiplexing techniques are already increasing the capacity of fiber optic transmission systems. AT&T Bell Labs has demonstrated a system that can move 20 Gbps through 68 km of optical fiber with the use of wave division multiplexing (WDM). Since the bandwidth-distance product (measured in Mbps x km) of lightwave systems has been doubling each year, researchers should ultimately be able to reach $10(x^9)$ Mbps-km using this and other techniques.[9]

Light source development is another vital research area. Presently, single-mode lasers are not reliable light sources for local loop applications. The very small core diameter of the single-mode fiber causes coupling problems between the fiber and the optoelectronic transducers, as well as the optical plugs and splices. While the high cost of lasers makes them currently uneconomical for such applications, laser light sources are expected to become viable in local loop applications as laser technology reaches a higher level of maturity, and production quantities increase. Intense research activity is currently focused on developing a low-cost optoelectronic transducer module containing a laser transmitter, PIN-diode receiver, and a WDM filter, with a target cost of less than $100.

Another promising research area involves optical detectors. Present experimental coherent detection systems have surpassed the performance of systems based on conventional direct-detection fiber optic transmitters and receivers. AT&T Bell Labs successfully demonstrated a 170 km. coherent lightwave transmission carrying 2 Gbps. Coherent transmission systems cannot become commercially viable until the problem of demultiplexing the densely packed WDM lightwave systems is solved. Tunable narrow-line-width lasers and sophisticated receivers are required to allow the coherent systems to operate at low bit rates.

Research in fiber optic technology is not confined to the United States. The Japanese government continues to fund much of the research and development of fiber optics, particularly in the area of optoelectronics. For example, a photo-reactive materials project is studying new organic superconductive materials as well as photo-reactive materials to be used in future generations of optoelectronics devices. In another research effort, thirteen companies are developing mass-produced optoelectronics devices and devices for short-distance optical communication applications, and to develop measuring equipment to be used in the production of coherent optical systems.

As a vital medium in digital network development, fiber optics research has assumed a high priority in the major European research and development projects now underway, including the Race and Esprit projects.[10] Race will stress integrated optoelectronics and components for high bit-rate long-haul lines. Funding for this effort is about $100 million. One-quarter of Esprit's efforts will be directed to advanced microelectronics. Work in this area will include development of integrated optoelectronic devices in high transmission systems; optical wideband LANs, and optical interconnects for very large scale integrated circuits (VLSI).

Future Growth of Markets

The global market for fiber optic systems will continue to expand. Research efforts are making such technology attractive for ever more applications. Companies both in the United States and abroad are intent on entering both foreign and domestic markets.

U.S. Fiber Optics Market. The U.S. fiber optics market will grow from $774 million in 1986 to $2.9 billion in 1992. This growth will be in response to new applications and more intensive use of fiber optics in existing applications, such as local area networks, federal government systems, and industrial/process control. Between 1986 to 1992, fiber optics use in new intercity and interoffice applications will decrease, while the use of fiber optics in feeder plant will grow at a five percent annual rate.

International Fiber Optics Markets. The fiber optics market in Europe should increase from $300 million in 1985, to $1.5 billion by 1991. Currently encompassing 25 percent of the world market, this market could well reach 35 percent by 1991.

Fiber installation will continue during the next decade, from a total of 400,000 cabled fiber-miles installed in 1986. With a steady annual growth rate of 80 percent, the installation of 140,000 additional fiber-miles is expected to be achieved during this year, with Great Britain, West Germany and France accounting for 70 percent of this amount. By 1991, over two million fiber miles will have been installed, with Germany expected to account for 40 percent of this projected figure.

Japanese markets are experiencing similar growth rates. According to Japanese industry statistics, demand for multi-mode graded-index fiber will rise from the 1985 level of 35,000 fiber-km to 800,000 fiber-km in 1990, an 87 percent average annual growth rate. The use of multi-mode step-index fiber is also expected to increase from 6,700 fiber-km in 1985, to 30,000 fiber-km in 1990; single-mode fiber will rise threefold from 82,000 fiber-km to 259,000 fiber-km in 1990. In the aggregate, this volume represents an average annual growth rate (in fiber-km) of almost 200 percent over a five-year period.

Notes

1. The desirable features of the optical fiber medium are numerous. The medium can carry hundreds of times more information over a greater distance and with less signal loss and noise than copper cable. One kilometer of fiber optic cable can carry as much information as 3800 one-km copper cables. Fiber enjoys a considerable size and weight advantage over copper cable and is immune to electromagnetic interference (EMI) and radio frequency interference (RFI). Optical fiber is more difficult (though not impossible) to "tap" than copper or satellites, enhancing its use in military, government and data networks. See U.S. Global Competitiveness: Optical Fibers, Technology and Equipment, USITC Publication 2054, January, 1988, p. 5. ("USITC")

2. Glass fibers may have differing optical characteristics, which affect the transmission capacity and signal loss qualities of the medium. The basic types include multi-mode, step-graded, and single-mode fibers.

3. This section is based largely upon information gathered by the staff of the International Trade Administration, U.S. Department of Commerce. ("ITA Staff").

4. Instead of installing wire pairs directly connecting customers with a local switching office, a telephone company may collect telephone traffic at a remote site prior to "feeding" it to the local switching office. The transmission plant connecting the switching office to the remote site is often called the feeder plant.

5. "The 1987-1992 Outlook for Fiber-Optics Use in the U.S. Telecommunications Industry," Telecommunications, Dedham, MA. 1987.

6. According to OITDA, demand for multi-mode graded-index fiber will rise from the 1985 level of 35,000 fiber-km to 800,000 fiber-km in 1990, an 87 percent average annual growth rate. The use of multi-mode step-index fiber is also expected to increase from 6,700 fiber-km in 1985, to 30,000 fiber-km in 1990; single-mode fiber will rise threefold from 82,000 fiber-km to 259,000 fiber-km in 1990. "ITA Staff"

7. "USITC," p. 27.

8. IGI Consulting, Inc. "Historical Development of Fiber Optics," U.S. Long Distance Fiber Optics Networks: Technology, Evolution and Advanced Concepts, Boston, MA. 02124, p. 11. ("IGI study")

9. M. Gawdun, "Lightwave Systems in the Subscriber Loop," Telecommunications, Dedham, MA., May, 1987, p. 66.

10. "ITA Staff". For a discussion of European research activities see "USITC", p. 10-3.

IV

Space Communication and Information Systems

by NTIA Staff

The United States on July 10, 1962, launched the world's first communications satellite, AT&T's Telestar, and on April 6, 1965, Early Bird, the first communications satellite in geosychronous orbit was deployed. Since that time, based largely with the continuing rapid evolution of satellite communications, the United States and the world community have progressed toward the proverbial "global village." In 1969, for example, 500 million people -- about one-sixth of the world population -- witnessed live via satellite the first human steps on the moon. In 1975, 1 billion people around the world saw the Montreal Olympics, and current estimates are that the 1988 Olympics in Seoul, Korea, which will be broadcast by over nine satellites around the world, will be viewed by more than 2 billion people, nearly half of the people on Earth.

The U.S. aerospace industry overall constitutes about a $100-billion-a-year business sector in the United States, accounting for approximately 750,000 U.S. jobs. Although the sale of satellites has fallen for the past couple of years due in part to the launch shortage resulting from the Challenger disaster and other launch and deployment failures, nonetheless sales amount to almost $2 billion annually. Communications satellites are the principal non-military factor in the missile and space vehicle part of the aerospace sector. Moreover, these applications represent the fastest growing sector of the industry. Aerospace, in short, is a very critical U.S. enterprise, and communications applications are one of the prime driving factors. Beyond this, of course, there could be no space exploration or commercial use of space without advanced communications technologies.

Satellites are used to provide services between fixed points (fixed satellite service), between mobile vehicles and fixed points (mobile satellite services), to locate the position of vehicles (radiodetermination and radionavigation services), to measure the properties of the earth's land, ocean surface, and atmosphere from space (satellite remote sensing), and to track weather (weather satellites).

In addition to linking the world together for communications and increasing our knowledge about the Earth and its environment, satellites and space exploration research has produced a plethora of advances in other fields. For example, the computer revolution of the 1980s is largely a spinoff of the 1960s' space program where the need to miniaturize electronic component led to the development of the microchip and microprocessor. As one recent article points out:

> *[D]erivatives of space research dating to the early Mercury launches are flowing continually into the marketplace, exploding into a bewildering array of consumer products...for instance, .. scratchless sunglasses .. portable dental drills and insulin pumps.... The value of NASA's spinoffs far outweighs the program's actual accomplishments in space.... Spin-off products... generate far more revenue each year and create far more jobs than the $6 billion spent annually on the space program.*[1]

The future holds the promise of even more exciting developments, discoveries and spinoffs. This chapter will briefly examine some of the technological trends and their impact on the development of space-based communications and information systems.

Geostationary and Polar-Orbiting Communications Satellites

The higher the altitude a satellite is moved in orbit, the longer it takes for the satellite to complete one rotation of the Earth. The space shuttle, at an altitude of about 200 miles, completes one orbit in about 100 minutes. The moon, which is approximately 225,000 miles away from Earth, takes 28 days for one complete revolution. At about 22,300 miles high, which is equivalent to the circumference of the Earth, a satellite orbits the Earth in 24 hours, the same as the Earth's rotational period. Thus, a satellite at this distance on an orbit going East to West above the equator, will revolve about the Earth at the same speed as the Earth turns. Consequently, the satellite is referred to as being "geostationary" relative to the Earth, or "geosynchronous" orbit so that it appears relatively motionless from the Earth.

Although most communications satellites are geostationary, some orbit over the poles to provide coverage to higher latitudes. This is because a satellite rotating over the equator has a lower "look angle" to locations on the surface of the Earth the further they are away from the equator. In the extreme northern and southern parts of the Earth, this angle of elevation to the satellite is such that the curvature of the Earth itself blocks the line-of-sight. However, by rotating a satellite well away from the equator on a polar route, communications to these higher latitudes is possible. These polar-orbiting satellites usually have a lower elliptical orbit with a very high apogee over the intended coverage area. This allows the satellite to be in view of the earth station for several hours. Satellite systems using polar-orbiting satellites have two or more satellites in the system so that at least one of the satellites is in view of an earth station at any time.

A satellite in a geostationary orbit has several advantages over satellites in moving orbits. Since the satellite does not move relative to the Earth, the transmitting and receiving antennas on the ground can remain pointed at it without shifting their position. The other big advantage of using a higher, geostationary orbit is that the satellite "sees," or has a "footprint" covering about one-third of the earth's surface. Thus, one satellite (depending on the configuration of its footprint beam) can provide communications to or among locations anywhere on that one-third of the Earth. Moreover, the communications are distance insensitive and can be provided for the same cost because, from the satellite's operational perspective, it makes no difference whether the communicators on Earth are ten or 10,000 miles apart.

Radio Spectrum

Space, although appearing mostly empty and void, actually is a medium for millions upon millions of voice, data and video transmissions, relayed around the world via radiocommunications. The usable radio spectrum is a portion of the overall electromagnetic spectrum that extends from extremely low frequencies (a few cycles per second, or Hertz) to visible light and up to X-Rays. The radio spectrum is generally between nine thousand Hertz (9 kiloHertz or 9 kHz) and around 300 GigaHertz (300 billion Hertz), but mostly used below about 40 GigaHertz (GHz). The usable radio frequencies for space applications are located generally above the high frequency (shortwave) band where signals are reflected back to Earth, and below those frequencies where the Earth's atmosphere severely attenuates radio signals. Several "windows" of these usable space frequencies exist for space-based radiocommunications systems. The rapidly expanding use of satellites for the relay of radio signals, however, has not filled these frequency windows because of the rapid advances in technology which have made use of these frequencies and orbital locations far more efficient.

In order to communicate using radio waves, information (whether data, sound or picture) is transmitted on waves which are picked up by an antenna and processed by a receiver. The process is essentially the same for all types of wireless communications and the range of communications is limited in most cases to the geographical region visible to the transmitter antenna. Thus, a satellite can only communicate to a receiver within that part of the Earth that it faces. The major advantage of relaying information through satellites is that, since they are hundreds or thousands of miles out in space, their transmitting antennas can reach many more receivers than any earthbound transmitter.

The frequency bands allocated for communications satellites are divided into "uplink" (Earth-to-satellite) and "downlink" (satellite-to-Earth) pairs. For each uplink frequency band, there is a corresponding downlink band. The downlink band is usually the lower of the two because the signal suffers less loss and the power of the satellite is limited by size, weight, and available electrical power. Satellite earth stations, however, are not so limited and can use sufficient power to overcome the additional signal loss of the upper frequency segment.

There are several downlink/uplink pairs in use for domestic and international communications satellites. The 4/6 GHz band, also termed C band, is widely used for international and domestic fixed (i.e., neither the receive nor transmit points are in motion during the transmission) telecommunications uses. The 7/8 GHz band is mostly used for military communications by the U.S. and allied nations. Because smaller antennas may be used, the 11-12/14 GHz (Ku) band is becoming popular for commercial fixed satellite communications. Satellite-based mobile services are provided in the 1.5 to 1.6 GHz band (L-band). Other bands exist at 17/18 GHz, 20/30 GHz, and 40/50 GHz. Higher bands are also allocated for this service, but technology is not yet advanced sufficiently to make these bands usable.

Communications Services

Most geostationary satellites are used to provide point-to-point and point-to-multi-point communications services between fixed stations on the Earth. Within the United States, fixed satellite services are provided primarily via nine domestic systems: Alascom, AT&T, Comsat, Contel ASC, GE Americom, GTE Spacenet, Hughes Communications, MCI, and IBM. The approximately 30 operational satellites used by these systems provide a variety of services including audio and video programming, satellite newsgathering, private line voice and data networks, teleconferencing, videoconferencing and long-distance telephone services. In addition, domestic satellites are used to provide transborder services to foreign countries which are incidentally within the footprints of these satellites.

The domestic satellite industry within the United States has been open to competition since 1972, when, following the advice of the Johnson Administration's Rostow Commission Report, the Nixon Administration implemented the "Open Skies" policy. Under this policy, satellites and their communications networks are privately owned and operated in competition with each other and their terrrestrial alternatives.

Twelve foreign countries own and operate satellite systems for the provision of domestic telecommunications: Australia, Brazil, Canada, the People's Republic of China, France, India, Indonesia, Italy, Japan, Mexico, West Germany, and the U.S.S.R. Additionally, at least a half dozen other countries are in the process of developing their own domestic satellites including the United Kingdom and Israel. INTELSAT also sells and leases satellite transponders for domestic use.

The primary providers of international satellite telcommunications services are the International Telecommunications Satellite Organization (INTELSAT), the International Maritime Satellite Organization (INMARSAT), the European Telecommunications Satellite Organization (EUTELSAT), the Arab Satellite Organization (ARABSAT), INTERSPUTNIK, and the Palapa system. INTELSAT and INMARSAT are global communications satellite cooperatives which provide space segment for international public telecommunications, and international maritime communications services, respectively. EUTELSAT is a pan-European regional system serving its 26-member countries. ARABSAT serves 22 Arab countries of North Africa and the Middle East. INTERSPUTNIK, formed in 1971 by the Soviet Union as an alternative to INTELSAT, primarily serves 18 Soviet Bloc nations. Palapa, an Indonesian satellite system, provides service to nations in Southeast Asia.

Today, at least 60 percent of all international telephone calls and almost all intercontinental television relays are via satellite. The primary impetus for the development of a global satellite telecommunications system lies with the United States initiative to share its technology and help link the world together in the peaceful use of outer space.[2] This led to the establishment of INTELSAT in 1964. INTELSAT began operations in 1965 with the successful orbiting of the U.S. built and launched Early Bird, the world's first commercial communications satellite. Early Bird's development was commissioned and financed by the Communications Satellite Corporation (Comsat), a private U.S. corporation established under the Communications Satellite Act of 1962 for the purpose of establishing an international communications satellite network.

Early Bird had a capacity of 240 voice circuits or one television channel. When orbited, Early Bird was the only mode of live transatlantic television, and it increased the telephone capacity across the Atlantic by approximately two-thirds. It had a design life of 18 months although, as often occurs with high quality satellite hardware it outlasted its estimated life and functioned satisfactorily in continuous full-time service for more than three years. In 1965, during a transatlantic submarine cable outage, Early Bird was used to restore service, the first of many times a satellite was used for cable restoration.

By the early 1980s, when the fifth generation of INTELSAT satellites were launched, each INTELSAT satellite could carry upwards of 15,000 simultaneous telephone circuits, as well as two color television channels. The next generation of INTELSAT satellites, the INTELSAT VI series, due to be launched beginning in 1989, will each have the capacity to provide 120,000 simultaneous telephone circuits, as well as three television channels, or 200 television channels in an all video mode.

INTELSAT currently uses 13 satellites to serve over 170 nations and territories. The annual cost of an INTELSAT telephone half circuit has come down from $ 32,000 in 1965, to $4,440 in 1988.[3] When adjusted for inflation, the difference is even more profound. From a fledgling organization a quarter of a century ago INTELSAT has grown to an international institution with net assets in excess of $1.5 billion, revenues for 1987 of $519 million, and an annual return on capital of 13.5 percent and growing.

INTELSAT, INMARSAT, and EUTELSAT are each organizations based on two international agreements. One is signed by the member countries, referred to as "Parties," and one signed by each Party or its designated representative, referred to as the "Signatory," which is responsible for the daily business and operation of the systems. Under this arrangement, each organization has the same number of Signatories as Parties. INTELSAT has 114 Parties, INMARSAT 55, and EUTELSAT 26.

The Signatory for most members is the government post, telegraph, and telephone (PTT) agency. The organizations are owned by the Signatories, with shares predicated on each Signatory's proportionate use of the system. The U.S. Signatory to both INTELSAT and INMARSAT is Comsat, with an ownership share of approximately 26 percent and 28 percent respectively.

Under the Communications Satellite Act, Comsat is required to provide non-discriminatory access to the INTELSAT system for all authorized users. Initially, under the FCC's Authorized User decision, Comsat was treated as a carrier's carrier providing space segment capacity to U.S. common carriers, but prohibited from offering services directly to the public. In the mid 1980s, the FCC revised its policy and authorized Comsat to also provide end user retail services. Although, Comsat engaged in this market for a few years, it recently returned to concentrating on its carrier's carrier jurisdictional role.

Geostationary satellites are also used to provide mobile services, a satellite based version of the now commonly-seen cellular telephone systems which currently provide terrestrial-based mobile telephone service to cars, trucks and others. In the case of mobile satellite services, the land, maritime, or aeronautical units communicate through a satellite instead of a ground relay station making even direct intercontinental mobile calls possible. These services will be likely offered at least initially, domestically by the American Land Mobile Consortium and globally by INMARSAT.

INMARSAT was created in 1978 primarily to serve international maritime customers. Currently, INMARSAT leases transponders on nine satellites (three of which are leased from INTELSAT) for the provision of mobile maritime communications. As INMARSAT prepares to launch its own second generation of satellites, it plans on expanding its services to include aeronautical and land mobile satellite based telecommunications

While maintaining the United States' commitment to the viability of INTELSAT, the United States Government has also authorized the establishment of separate satellite systems. These systems will help bring competition and new service offerings to the international satellite marketplace. The first of these separate international satellite systems, PANAMSAT, joined by a number of foreign participating parties, is completing its consultations with INTELSAT. It now has its first satellite in orbit and will soon be operational.

Satellites also provide radionavigation and radio- determination services, including radiolocation service for airplanes, trucks, and ships. Within the United States at least two companies, Geostar and Omninet, will be providing radiodetermination services. In addition, specially designed satellites are used internationally to relay emergency beacons set off by downed pilots or sailors in distress.

As the use of the geostationary orbit has increased, there has been a growing concern, particularly among the less developed nations, that the available slots and frequencies will be taken by the developed nations before other countries are ready to launch their own satellites. This is because countries have been able to use these orbital locations on a first come, first served basis. To help ensure developing countries' ability to use the geostationary satellite orbit (and the frequency bands allocated to the space radio communications services in the future, there have been a series of international conferences sponsored under the aegis of the International Telecommunications Union (ITU). At the most recent meetings, the 1985 and 1988 World Administrative Radio Conference on the Use of the Geostationary-Satellite Orbit (Space WARC), some countries have sought to establish a mechanism to ensure guaranteed access by all countries to the geostationary orbit. This approach has been referred as *a priori* planning.

In contrast, the United States and other developed countries point to the technological advances that have expanded and will continue to expand the number of usable geostationary orbital slots. By increasing the functional capacities of satellites and earth stations to precisely discriminate in their communications, additional satellites can be positioned between existing orbital slots without increasing the radio interference due to spillover. Thus, whereas satellites were initially separated by five or more degrees of orbital arc, they can now operate, using the same frequency band, in orbital positions as close as two degrees apart. Through continued technical improvement, shifting traffic modalities, and shared use of international and regional satellite systems, the developing nations will be assured their place in the geostationary orbit whenever they may be ready to launch their own satellites.

Direct Broadcast Satellites

Direct Broadcast Satellites (DBS) are communications satellites which transmit television program-carrying signals directly to earth stations located at home or business premises, providing, in effect, satellite-based wireless "cable" television. The relevant ITU Radio Regulation uses the term "broadcasting-satellite service" and defines it as a "radio-communication service in which signals transmitted or re-transmitted by space stations are intended for direct reception by the general public."

Although it is technically feasible to broadcast at high power directly from a geostationary satellite to a small home receiving set, it has not been clear whether such direct broadcast satellites are economically feasible for much of the developed world, which already has in place extensive terrestrial facilities for national broadcasting. The FCC established domestic regulatory policies for DBS in 1982 and approved proposals by eight applicants. Nevertheless, six years later, high-powered DBS is still only at the drawing board stage. Nevertheless, it should be noted that the roughly $200 million price for starting a DBS system may be small in comparison with prices paid for single major market TV stations, which offer only one channel, and have sold for as much as $500 million.

Although there are no U.S. domestic high powered DBS services, there is a well-established low-powered satellite television receive-only (TVRO) industry operating within the United States. Beginning in 1975, in response to the relaxation of the FCC's earth station rules, Home Box Office (HBO) began delivering its movie and entertainment programming via satellite to cable systems throughout the United States. Although HBO and other cable programmers intended for their programming to be received only at cable headends and transmitted to homes via coaxial cable, consumers quickly discovered that these signals could also be received directly by backyard earth stations, the TVROs. These earth stations were initially popular in rural areas not served by cable television services, and later spread to consumers seeking either additional video programming or avoidance of the prices charged by cable operators. Because the programming carried by satellite was not scrambled, home reception was, in effect, free. As the popularity of these backyard TVROs rose, cable program suppliers and operators became increasingly opposed to this unintended, unreimbursed reception and instituted signal scrambling to prevent the free reception. Cable programers do now offer programming packages, including descrambling processors, to these backyard dish owners at prices approximating those charged by cable systems. Currently, there are approximately two million backyard dish owners.

The TVRO industry is, however, different from traditionally conceived DBS in two respects. In the first place, DBS was envisioned as a service to be received by very small earth stations, requiring the use of high-powered satellites. Secondly, these TVRO services, even the current packaged versions, are at most only incidental reception of programming intended either for over-the-air broadcasting at a distant point, or for cable television. These services are not tailored for a distinct DBS market and they do not provide different programming. Indeed, one the biggest hurdles faced by would be DBS venturers is access to or the creation of unique or exclusive DBS programming.

A powerful impetus for establishing a DBS system may be as an outlet for high definition television (HDTV). The Japanese already are planning to distribute HDTV by means of a domestic Japanese DBS satellite, and similar plans are being developed in Europe.

For some developing countries, direct broadcast satellites would make it possible to establish national television systems. Nations sharing a common language and culture could establish regional networks. The satellite could be used for education and to provide cultural and entertainment programing as well.

One of the perceived impediments to the development of a viable DBS market in the United States is the size and cost of the home earth station. The parabolic antenna of the kind found in backyards and on commercial building rooftops has been the way to receive satellite signals since the advent of satellite communications. Improvements have been made in the design over the years, but even with the introduction of VSATs (very small aperture terminals), which are now 1.8 meters in diameter and smaller, the dishes remain too large, cumbersome and expensive for the average mass market residential customer for DBS service.

Further reductions in size and cost may provide the technological solution. For residential users there is the added incentive that smaller earth stations can be used by people who might otherwise prefer not to clutter their backyard or roof with unsightly earth station dishes. The flat antenna is an outgrowth of these concerns, but is not a new phenomenon. It has been used for years by the military, but proved to be too expensive for the commercial market until recently. With recent technical advances that are making the flat antenna economically feasible for commercial applications, a major hurdle for development of DBS will soon be overcome.

Space Information Systems: Remote Sensing Satellites

Satellite remote sensing of the earth involves the use of sensors that measure the properties of the earth's land, ocean surface, and atmosphere by scanning specific bands of radio frequency radiation naturally emitted. By comparing the relative amounts of electromagnetic radiation reflected from or emitted by the objects or areas under investigation, advanced computer processing techniques can ascertain mineral resource deposits, vegetation, cloud cover and temperatures. These satellites are used primarily to track weather systems or to scan land masses, and their level of resolution varies accordingly. Weather satellites are designed to view clouds and other large scale phenomena such as hurricanes many miles in diameter. Land remote sensing, where objects such as roads and buildings are being measured, uses much sharper resolution.

The U.S. Landsat system, now operated by the Earth Observation Satellite Company (EOSAT), can currently resolve objects no smaller than 30 meters. The French SPOT system has a 10 meter resolution ability. The Soviet Union is currently marketing remote sensing images with 5-meter resolution, but will only sell data relating to the country in which the purchaser is located, and only outside of the Soviet Bloc. The resolving abilities of sensors are improving and the coming generations even of commercial remote sensing satellites will be able to achieve resolutions of under 5 meters. This raises, among other things, some very complicated national security issues. The U.S. Department of Commerce has established regulations for the licensing of private remote sensing firms operating in the United States.

The news media have now also expressed interest in orbiting their own remote sensing satellite system.[4] With greater resolution, remote sensing data can be used in broadcasts and in print showing otherwise inaccessible news events. The impact of this new technology was brought into most living rooms when people saw dramatic photos of the crippled Chernobyl nuclear plant taken from space. Use of these systems is likely to grow.

Future Developments

Satellite communications has transformed our world and the way we see it. Dramatic technological advances and entrepreneurial creativity have linked nations and people together, brought shared experiences to the world, and provided services undreamed of only 25 years ago when these systems began. But this technology is neither "old hat" nor static. As impressive as previous advancements have been, they may well be dwarfed by the planned introduction of new satellite communications technology in the 1990s.

For example, conventional satellites essentially act as a "bent pipe" in the sky -- receiving and amplifying a signal from one earth station and retransmitting it, without demodulation, to another. NASA has undertaken to develop and demonstrate an Advanced Communications Technology Satellite (ACTS) that will provide on-board demodulation, processing, and switching of received signals, and their selective distribution to any one of several dozen earth points, based on control signals relayed from the transmitting terminal. In effect, ACTS will put the switching capability of a telephone company central office switch in geosynchronous orbit -- and make any fraction of its 220 Mbps capacity available to specific users within microseconds after an access request. Phased-array antennas will enable switching of 100-mile wide spot beams among any number of earth points on a microsecond basis, and will provide dramatic improvements in spectrum efficiency through frequency re-use. The development of Ka-band (30/20 GHz) technology will expand available bandwidth by a factor of 5, and will reduce the minimum earth station antenna size to 1 meter or less -- a factor of 10 reduction in comparison to older C-band equipment. Availability will be substantially improved through the use of forward error correction for on-board rain fade compensation.

The on-board baseband switching capability of advanced communications satellites will allow Very Small Aperture Terminals (VSATs) to communicate directly via a single hop. That will substantially improve VSAT performance. On-board processing of baseband signals will make it possible to enhance satellite transmission performance through the use of forward error correction (FEC) codes. FEC codes can effectively eliminate digital errors caused by rain fading and other propagation impairments, but their efficient use in satellite communications requires on-board processing because such impairments are often uncorrelated between the up and down links. On-board switching and processing capability should also enhance the capability of communication satellites to be used in integrated services digital network (ISDN) applications. Switched satellites may in fact be the only way to extend ISDN coverage to mobile terminals, and to terminals in sparsely populated areas. A switched satellite could also be used very effectively as the central hub of a private ISDN serving a geographically dispersed organization.

Spot beams today enable a satellite's transmission capacity to be shared among users much more efficiently than had been possible with conventional broad coverage beams. The use of spot beams enables extensive reuse of satellite transmission frequencies. The same frequency can be used simultaneously on several beams pointed in different directions, thus effectively increasing the satellite's capacity and relieving pressure on spectrum resources. Frequency reuse can be further enhanced by cross-polarizing adjacent beams. Spot beam techniques are particularly attractive in military communication applications, where they make it possible to "null out" jammers and greatly reduce the possibility of unintended reception of satellite signals. Spot beam technology too is developing rapidly. In the future, the satellite's overall service area will be repeatedly scanned by the spot beam, which hops from one coverage area to another. If an earth station has traffic to send or receive, the spot beam dwells (momentarily stops) on its coverage area while the traffic is communicated in a high data rate burst. The hopping pattern can be changed rapidly to adapt to changing traffic conditions. Coverage areas with little traffic are illuminated for a short time, those with more traffic for a longer time. This adaptivity too increases the efficiency of the satellite by allocating its resources (power, bandwidth, and time) to earth stations according to their instantaneous traffic demands.

As satellite technology continues to develop and be put to use by creative businesses, the communications abundance it has helped provide should continue to function as the backbone and nervous system of international commerce, give more and more people access to a better quality education, enhance the conduct of businesses in space, and contribute toward greater peace and understanding.

Notes

1. Bill Inman, "The Space Spin-Offs," Business (London), March, 1967, Volume 2, Number 1, p. 89.

2. See, e.g., President Kennedy's "man-to-the-moon" message to Congress of May 25, 1961 and the Preamble to the Communications Satellite Act of 1962

3. A satellite half circuit consists of the communications link from an earth station to a satellite transponder. In order to communicate, two half circuits are required.

4. U.S. Congress, Office of Technology Assessment, "Commercial Newsgathering From Space: A Technical Memorandum," June, 1987.

V

Land Mobile Radio Services

by Alfred Lee

Land mobile radio applications can be found in virtually every sector of society, ranging from public safety and local government activities to business and industrial applications. It is possible to categorize various mobile radio applications into three generic types based largely upon message duration and other characteristics:[1]

> One-way Signaling (Paging). User applications employ a very limited-duration radio signal to alert or instruct the user to do something. The user (an office machine repairman or doctor, for example) carries a small unit which is capable of receiving one of three types of signals: tone-only, tone-voice, or alpha-numeric messages. In the tone-only service, the receiver emits a tone and the user takes some predetermined action, such as calling his or her office or telephone answering service. In the tone-voice service, the tone is followed by a short voice message which delivers instructions (e.g., call a specific number). Tone-only service is cheaper than tone-voice because less "air time" is used and the equipment can be somewhat less complex. In the alpha-numeric service, a short alphabetic or numeric message (such as the telephone number to be called) is delivered to the receiver and displayed on a small readout device. Paging signals are very short duration transmissions, relative to the other message applications.
>
> Dispatch Communications: User applications allow two-way, typically one minute or less, voice conversations between a base station and mobile units or between mobile units. Dispatch communications are generally a feature of private radio systems and are often used to coordinate and control an organization's resources (e.g., a fleet of police vehicles, taxis, or delivery personnel). The mobile user usually converses with a dispatcher at the base station, but sometimes talks directly to another mobile user. Mobile dispatch service users generally cannot directly contact a local telephone subscriber. Private dispatch service users, however, can gain access to the public-switched telephone network by meeting special interconnection requirements. Dispatch

communications increasingly include tone signals and alphanumeric messages.

Mobile Telephony: User applications permit the mobile user to receive or place regular calls through the exchange (local) and message toll (long distance) facilities of the public-switched telephone network. The mobile service is commonly interconnected with and can be an extension of regular landline service. The mobile telephone unit can be mounted in a vehicle or carried by a person. Mobile telephone messages are typically of much longer duration than other mobile radio applications.

Based upon the characteristics of the messages carried, the number of radio channels common to each system, and the nature and purpose of the mobile radio user, the Federal Communications Commission (FCC) has established land mobile radio service categories. These services include various private carrier and public common carrier services. Technical requirements and guidelines limiting the number of mobile units per radio channel (sometimes referred to as channel loading criteria) help to delineate these services.[2]

The FCC licenses several types of land mobile radio services. The public land mobile services offer services to the general public. The private land mobile services provide "regularly interacting" users of "base, mobile, portable, and associated control and relay stations (whether licensed on an individual, cooperative, or multiple basis) with radio communications."[3] Traditionally, equipment used for both public and private land mobile radio services has been carried in vehicles. But advances in solid-state electronics have made smaller and much more portable units such as pocket pagers, portable telephones, and hand-held mobile radios, increasingly popular.

The FCC licenses common carriers to use specific radio frequencies for various public land mobile services. These mobile common carriers consist of "wireline" carriers (those companies also providing landline local exchange telephone service) and "non-wireline" carriers (also referred to as radio common carriers.) Specific radio frequencies are available to these carriers to offer paging services or mobile telephone and, to some extent, dispatch communication services.[4] A separate set of radio frequencies is used for cellular mobile telephone services.

Private land mobile radio services can be grouped broadly according to several categories: various conventional radio user categories, specialized mobile radio (SMR) services, and paging services. The conventional radio user categories include: public safety, special emergency, industrial, land transportation, and radiolocation services. SMR services are most commonly licensed as multichannel, trunked systems. The FCC allows private paging services to operate within the user-delineated, conventional radio service categories and the SMR services. In addition, private paging services are also licensed to operate on specifically dedicated frequencies.

Key Industry Statistics

Public Land Mobile Services

Currently, some 3,500 mobile common carriers provide mobile telephone, paging and other services. In the last year alone, the number of non-wireline carriers has jumped from 1,000 to 2,500 entities. While public land mobile radio services have seen steady growth in recent years, one application in particular, cellular mobile telephony,[5] continues to grow at a very dramatic rate. No doubt, much of the current interest in public land mobile services can be attributed to this particular application.

Cellular Mobile Telephone Services

In establishing the market structure for cellular radio development, the FCC initially allowed two licenses to be granted in each market, one license to the local wireline carrier and a second license to a non-wireline carrier. While the local wireline carrier was customarily granted a cellular license, the non-wireline licensee was chosen by two different methods, depending upon the market. In the top thirty markets, non-wireline licenses were assigned by comparative hearing. For each of the 275 next largest markets, a lottery system was used to select the non-wireline licensee.

The cellular radio licensing process has generated substantial activity by the FCC and the land mobile industry. Over a four-year period, the FCC reviewed almost 100,000 applications for cellular radio licenses for the top 305 markets. Since assigning cellular radio licenses to mobile common carriers in the 305 largest markets, the FCC has delineated more than 400 rural service areas. The FCC expects to receive as many as 200,000 license applicants for these markets and again intends to use lottery license assignment procedures.

Since the first cellular mobile telephone system was inaugurated over four years ago, the activity and growth of this sector has been truly phenomenal. Table 1 illustrates how quickly the industry has moved to develop cellular services. Between 1984 and 1987 the number of systems grew almost ten-fold while the number of cities with cellular services expanded to over seven times the 1984 level. During each of the last several years, subscribership has been almost doubling previous year levels.[6] Based upon current operations, cellular service is now available to approximately 70 percent of the national population.[7] Consultants project as many as 2.5 million subscribers by 1990.

Some consolidation appears to be occurring in the cellular industry. Several wireline carriers have acquired non-wireline cellular systems, outside of the wireline carriers' operating territories. Perhaps the most dramatic is the Southwestern Bell Corp. acquisition of Metromedia's six cellular franchises, bringing Southwestern's cellular franchise total to 16 markets with 133,000 subscribers. Two companies, McCaw Cellular and Southwestern Bell Mobile have over 60 million out of 200 million potential customers controlled by the top ten cellular companies.

TABLE 1
Growth of Cellular Radio Services

Date	Number of Systems	Number of Cities	Subscribership
1984	33	26	91,600
1985	105	81	340,000
1986	171	104	682,000
1987	312	199	1,230,000

Revenues from both the cellular equipment and service industries are expected to continue to grow at a steady rate. Revenues for cellular equipment in 1987, alone, totalled about $500 million for system equipment (i.e., switching and base station equipment),[8] and $500 million for subscriber equipment. By 1990, the cumulative totals for system and subscriber equipment are projected to reach $5 billion and $1 billion respectively. Annual service revenues are expected to rise from about $1 billion in 1987, to $2.6 billion by 1990.[9]

Cellular radio service rates are now reasonably affordable, especially for the business user. Several years ago, average monthly service charges ranged from $150 to $200. Current rates have dropped by as much as one-half of these earlier charges. Across the country fixed monthly charges range from $20 to $50, with per minute calling charges of $0.35 to $0.50.[10] Current average service costs have been estimated at $100-$125 per month.

Subscribers can purchase or lease three types of cellular telephones.[11] Vehicular telephones are typically priced between $1,000-$2,000 and lease for $20-$70 per month, although discount prices of $500 are available. These prices are roughly one-half of 1985 cellular telephone prices. Somewhat smaller transportable telephones are also priced at $750-$3,000, while portable telephones are priced $1,000 higher. By 1990, while vehicular telephones can be expected to cost less than today, they may be less dominant in terms of market share.[12] Portable and transportable units may represent as much as one-half of the 1990 cellular subscriber equipment market.[13]

Public Paging Services

Public paging services have been organized as local systems, or as regional/nationwide systems. A recent survey estimated an aggregate total of 6.5 million pagers operating in 1987, generating annual service revenues of $2 billion.[14] While the annual growth rate of paging users has been 15-20 percent over the last four years, analysts predict a somewhat slower future growth rate. Current projections forecast 10 million paging customers by 1991 and 15 million customers by 1995.[15] One consultant predicts as much as 85 percent of these customers will use local systems.

Regional and nationwide public paging services are developing rapidly.[16] Since the FCC awarded three licenses in 1985 to operate paging services on nationwide channels, two companies have commenced operation in 51 cities and 16 cities respectively.[17] Other companies have been able to develop regional paging services, linking many cities each having local paging channels. One company has used FM subchannels, rather than paging frequencies. Monthly rates for regional and national paging services range from $50-$80, while local services are typically $40 less.

A 1985 study of the paging industry examined the mix of paging units in use. Voice pagers represented 45 percent of the subscriber equipment market, followed by tone-only units (39 percent) and digital display units (16 percent). In comparison with 1984 data, digital display and tone-only unit use increased 100 percent and 34 percent respectively over 1984 levels, while voice pager unit growth remained flat. Analysts forecast a $1 billion pager market by 1990, with an equipment mix of 60 percent digital display, 30 percent tone-only, and 10 percent tone-voice units. Paging customers seem to have a growing preference for digital display units.

While paging services are being used throughout the economy, several sectors find such services to be particularly useful. One-third of all pagers counted in the 1985 study were used by service industries. The construction and the transportation/utilities/communications sectors were also large users, each employing about 15 percent of the total. Voice pagers were used extensively in the service and construction industries, while tone-only pagers were popular in the transportation, utilities, and communications sectors.[18]

Private Land Mobile Services

Three types of systems currently provide private land mobile services. Conventional mobile radio systems are the most common. These systems usually operate on, but are not limited to, one radio channel or channel pair. In the case of multichannel systems, the user selects a channel manually. Trunked systems are multichannel arrangements (usually 5 or more channel pairs) which use computer technology for automatic channel selection. Trunked systems are typically able to use radio spectrum more efficiently than conventional systems. Paging systems have been described earlier.

The private land mobile radio sector is very large and continues to grow. Among the more than 2.5 million private radio systems licensed by the FCC, just over one-half of these licensees operate private land mobile services. Licensees may provide conventional, paging, or SMR services for use by those eligible for private land mobile radio services. While the entire sector is growing steadily, SMR services, in particular, are growing at a very rapid pace.

Each year, the FCC receives approximately 350,000 applications to operate private land mobile services in various radio frequency bands.[19] While the FCC continues to license all of these services, it relies on officially designated private sector groups, called frequency coordinators, to recommend frequency assignment and sharing arrangements for applicants. By certifying frequency coordinators for the radio services the FCC seeks to minimize application processing delays, encourage inter-service frequency sharing, and to facilitate the introduction of new technologies. To deal expeditiously with the overwhelming interest in SMR service development, the FCC first used a lottery scheme in 1984 to assign SMR licenses for service areas in which demand of radio channels exceeded the supply. The FCC has eliminated the lottery scheme in favor of a waiting list procedure to assign SMR licenses.

Conventional Private Services

The FCC actually licenses 20 different conventional private land mobile radio services. Table 2 shows 1983-1987 license data for these categories and services. Business and special industrial users are predominant. Within the land transportation service, the railroads are the largest group of license holders. The average annual growth of licenses in industrial, land transportation, and public safety services has been steady. Between 1983 and 1987 the industrial service and public safety service both grew the most rapidly with an average annual growth of over 6 percent. Land transportation licenses grew an average of almost 3 percent annually.

Private paging services are allowed to operate within the private services and on special paging frequencies. In 1985, the FCC apportioned 40 radio channels, assigned one year earlier to private paging services, into two 20 channel pools for commercial and non-commercial operations. Commercial paging operators are allowed to provide services for private land mobile radio users. These actions effectively doubled the number of channels available for use by private paging operators. Table 3 shows a 23 percent average annual growth in private paging system licenses from 1983 to 1987.

Conventional land mobile equipment sales have been growing steadily. Over 238,000 complete land mobile radio systems (including transceivers, base stations, and antennas) were sold in 1986, alone, representing a 15 percent increase over the previous year. Annual revenues from such system sales amounted to $187 million in 1985 and $231 million in 1986. Sales of vehicular mobile radio equipment have averaged almost $62 million a year over the last two years. Annual sales of portable receivers and pagers grew from 1.3 million units in 1985 to 1.7 million units in 1986. Consultants project an increase from 9 million mobile transceiver units in 1985 to 12 million units by 1990.

Specialized Mobile Radio (SMR) Services

SMR services were created in 1974 to allow private land mobile radio services to be provided on a commercial basis. SMR systems operate as conventional systems or, much more typically, as multichannel trunked mobile radio systems. Four user categories are currently defined for licensing purposes: business, industrial/land transportation, public safety/special emergency, and SMR trunked or conventional community services. Since their inception, the SMR services have had an astronomical growth, more than doubling the number of licenses granted in

TABLE 2
Private Land Mobile Radio Stations in Use
1983 - 1987

Services	1983	1984	1985	1986	1987
INDUSTRIAL					
Business	510,813	561,610	610,903	637,138	647,962
Forest Products	6,550	9,089	10,042	10,649	11.020
Manufacturers	11,770	16,882	18,866	19,906	20,875
Motion Picture	358	328	377	391	391
Petroleum	22,323	23,544	25,819	26,662	26,562
Power	28,288	31,367	35,888	38,397	41,170
Relay Press	734	1,084	1,134	1,179	1,236
Special Industrial	94,728	110,195	116,819	118,650	117,038
Telephone Maintenance	3,599	5,553	6,060	6,464	7,086
Total	679,163	759,592	825,908	859,446	863,360
LAND TRANSPORTATION					
Automotive Emergency	7,379	7,745	7,940	8,189	7,958
Railroad	12,036	12,432	14,188	15,016	15,100
Taxicab	6,274	6,053	6,155	6,053	5,974
Motor Carrier	10,179	9,525	10,163	10,575	10,787
Total	35,868	35,755	36,446	39,833	39,819
RADIOLOCATION					
Total	4,337	8,333	7,528	6,809	5,823
PUBLIC SAFETY					
Fire	27,242	34,868	37,429	39,101	40,224
Forestry Conservation	8,749	8,850	3,844	10,187	10,422
Highway Maintenance	11,556	11,907	12,958	13,541	13,849
Local Government	44,463	52,029	57,652	61,313	63,664
Police	47,802	41,114	43,446	45,429	46,517
State Guard	5	-	-	-	-
Total	139,817	148.768	161,329	169,571	174,676
Special Emergency					
Total	32,339	35,464	38,212	39,433	39,723

three years. Table 4 shows cumulative license data from 1984 to 1987. A recent estimate has identified approximately 3,000 trunked SMR operators in the United States. Business services continue to dominate both the conventional and trunked operations, consistently representing over 90 percent of these licenses.

TABLE 3
Private Paging Licenses 1983 - 1987

Year	No. of Licenses
1983	508
1984	811
1985	802
1986	885
1987	980

(Source: FCC)

TABLE 4
Special Mobile Radio Licenses by Service
1984 - 1987

Service	1984	1985	1986	1987
CONVENTIONAL				
Business	18,351	19,424	20,293	21,646
Industrial/ Land Transportation	2,726	3,278	3,742	4,122
Public Safety/ Special Emergency	1,529	1,783	2,093	2,340
SMR Conventional	498	558	660	671
TRUNKED				
Business	60,229	93,189	127,036	165,890
Industrial/ Land Transportation	284	458	665	782
Public Safety/ Special Emergency	388	698	1,013	1,436
SMR Trunked	2,309	2,770	2,941	3,499
Total Conventional and Trunked Licenses	86,314	122,158	158,443	200,386

(Source FCC)

The FCC has made great efforts to speed the license assignment procedure and to ensure that assigned channels are used sufficiently. By adopting a lottery scheme to select SMR licensees in 1984, the FCC was able to keep pace with the high volume of applications for SMR service operations. At the same time, the FCC has been concerned that these assigned channels are used properly and in a timely manner. In 1985 and 1986, the FCC recovered 646 and 405 channels respectively, from underloaded or unconstructed SMR systems. Since the channel recovery program began, over 2200 channels have been reassigned to other SMR applicants.

Perhaps it is no surprise that sales of SMR mobile units have been growing at a rapid pace. The FCC recently estimated that there were some 670,000 mobile units associated with SMR systems. Three-fourths of these units were operating on trunked systems. Table 5 shows earlier estimates of both annual and cumulative sales of mobile units between 1979 and 1985. Since 1982, annual sales of SMR mobile units have been almost doubling the annual sales totals from each previous year. Consultants have projected between 2-3 million mobile units by 1990, and as many as 5-7 million SMR units by 1995.[20]

TABLE 5
Annual and Cumulative Sales of SMR Mobile Units
1979 - 1985

Year	Cumulative Unit Sales	Annual Unit Sales
1979	5,000	5,000
1980	19,000	14,000
1981	34,000	15,000
1982	55,000	19,000
1983	90,000	35,000
1984	150,000	60,000
1985	260,000	110,000

Critical Industry Developments[21]

Among the earliest users of land mobile radio were local police departments.[22] Early experiments with one-way radio systems in the 1920's, operating from police headquarters to patrol vehicles, evolved successfully into two-way mobile radio services. During the 1930's, two-way land mobile services were initially allowed to operate under temporary experimental licenses and private land mobile radio systems began to proliferate.[23] These early systems were used for emergency operations with no interconnection with the local telephone system provided.

The post-World War II period saw a sustained growth of private services and the advent of public or common carrier services. Demand for land mobile radio reached a point that by the mid-1940's, the FCC established several services in addition to the already established Emergency Radio and Miscellaneous Radio Services.[24] With the allocation of radio frequencies for public land mobile radio services, mobile telephone services were allowed to operate initially on an experimental basis.[25] By the late 1940's public paging services were also in operation.

Through a ten-year period following 1948, the FCC authorized various private mobile radio applications. In 1949, in establishing the Special Industrial Radio and other services, the FCC formally sanctioned the use of mobile radio to support commercial and industrial purposes.[26] The FCC later identified new subcategories of industrial users, as the conventional land mobile radio service categories were restructured to look much like they are today.

Since their inception, land mobile radio services have faced rapid growth and periodic problems of radio channel congestion. Both technical advances and various FCC decisions in land mobile radio services have attempted to alleviate the crowding on radio channels. Early research and development undertaken by the engineering and military communities made radio frequencies far above the AM broadcast service band usable for land mobile radio and other applications. With these technical developments, the FCC was able to allocate radio frequencies to land mobile radio services from the newly available radio spectrum. By 1968, approximately 39 MHz of electromagnetic radio spectrum had been allocated to private land mobile radio services, while public land mobile radio services used only 3 MHz.

Technical advances were also responsible for improved performance of radio systems. For example, the development of frequency modulation, authorized for use by land mobile radio services in 1941, offered several technical advantages over amplitude modulation systems.[27] With other improvements in two-way radio equipment, the FCC was able to compel land mobile radio users to conserve radio spectrum by reducing the channel spacing of their systems.[28] While technical changes and new radio frequency allocations did help somewhat, the problems of channel congestion, exacerbated by continued rapid growth of the industry, did not disappear.

In the late-1960's, in response to continuing congestion, the FCC considered various frequency reallocation proposals, to make more radio spectrum available for use by the land mobile radio industry.[29] A 1968 proposal to reallocate UHF-TV channels 14 through 20 in large urban areas to land mobile radio services, brought land mobile and broadcast interests into conflict.[30] Two years later, the FCC allowed such vacant UHF-TV channels to be assigned to land mobile users in the ten largest mobile radio markets.[31] In a related proceeding, the FCC considered reallocating a block of radio spectrum between 806 and 947 MHz which included UHF-TV channels 70 through 83, broadcast auxiliary, and government services. After six years of deliberation, the FCC made this reallocation, almost quadrupling the amount of radio spectrum available to land mobile radio services. This frequency band is commonly referred to as the 800 MHz band.[32]

With this action, the FCC faced the issue of how the reallocated spectrum would be divided within the land mobile radio industry. Historically, the FCC had allocated radio spectrum to public and private services, based upon user categories. Through a series of decisions spanning the early 1970's, the FCC departed from that practice in favor of an allocation scheme based upon technology used. Forty MHz of spectrum was allocated to cellular radio operations,[33] while 30 MHz was allocated to conventional and trunked private radio operations. The remaining 45 MHz of spectrum was held in reserve.

Several features of these decisions shaped private land mobile developments over the next decade. The FCC decided initially to authorize only 300 of the 600 paired channels established by the 30 MHz allocation to conventional and trunked operations. To encourage the development of spectrally-efficient trunked systems, the FCC designated 200 channels for trunked systems and 100 channels which could be used for single-channel, conventional operations. A particularly controversial part of the 1974 FCC decision was the creation of a new license classification, within private land mobile services, now called specialized mobile radio (SMR) operations. SMR licensees were allowed to provide mobile services, on a commercial basis, to users eligible for private mobile radio services. Virtually all of the hundreds of systems licensed on the 200 trunked channels, released in 1974, operate as SMR services.

Demand for private land mobile radio service, over the next eight years, caused a shortage of radio channels in major metropolitan areas, prompting the FCC to release the remaining 300 channels, already reserved for private land mobile radio services. The channels were released in two blocks. In 1978, 50 channels were allowed to be used for conventional mobile radio systems. By 1982, the FCC found it necessary to release the final 250 channels. But this last block of channels was not designated by system technology. Instead, the channels were divided into four service specific categories: SMR (80 channels), Public Safety/Special Emergency (70 channels), Industrial/Land Transportation (50 channels, and Business (50 channels). Licensees in each of these categories were allowed to choose either trunked or conventional technologies to meet their needs.

One particularly important decision, made with the release of the last block of channels, was the adoption of a lottery scheme for assignment of SMR licenses in service areas where demand exceeded available channels. During the first license application filing period in 1982, the FCC received applications for more channels than were available to SMR services in fifteen markets. A lottery scheme was used, beginning in 1984, to assign licenses in these areas.

The release of two 800 MHz blocks of private land mobile reserve channels in 1978 and 1982 only partially alleviated congestion in the largest metropolitan areas. With the release of radio channels in 1982, license applications for SMR channels immediately exceeded demand in key metropolitan areas. By 1984, it appeared that other mobile radio service categories were experiencing similar growth.

Based upon such growth in both public and private services, the Land Mobile Communications Council in mid-1984 petitioned the FCC for action in three areas. It called for the release of 20 MHz of land mobile reserve for private systems and 12 MHz for common carrier cellular systems. Secondly, it asked for private land mobile sharing of vacant UHF-TV channels in 21 metropolitan areas. Third, the petition asked the FCC to explore the potential use of 220-225 MHz for land mobile radio applications.

In response to public discussion of this petition, the FCC proposed new rules in these three areas. In late 1984, the FCC proposed allocation of the entire 32 MHz of the 45 MHz of land mobile reserve, considered to be appropriate for mobile operations.[34] Roughly six months later, the FCC proposed private land mobile radio sharing of up to 6 unassigned UHF-TV channels in 8 metropolitan areas.[35] In 1987, the FCC proposed allocation of 2 MHz in the 220-225 MHz band for private land mobile radio use.[36]

The FCC's proposed land mobile radio reserve allocation brought various interests within the industry into conflict. The Commission considered allocating 12 MHz each to cellular and private land mobile services. An alternative approach was to combine the 24 MHz for general purpose mobile communications without specifying service categories. In addition, it proposed to allocate 8 MHz of reserve to a new mobile satellite service. After 20 months of deliberation, with the industry and Congress articulating their concerns, the FCC decided how to allocate the reserve, commonly referred to as the 900 MHz band.[37]

The 900 MHz allocation decision attempted to balance the immediate needs of land mobile radio interests and to introduce new possibilities. Cellular radio services received 10 MHz, divided equally between wireline and non-wireline carriers. Private land mobile radio received 16 MHz. The FCC designated 5 MHz (or 200 channels) for trunked SMR services, 2.5 MHz each for Industrial/Land Transportation (or 99 channels) and Business (or 100 channels) services, and 6 MHz for the Congressionally-mandated National Plan for Public Safety. The Commission also created a new General Purpose Mobile Service and allocated 2 MHz of radio spectrum. Finally, 4 MHz has remained as reserve radio spectrum.

Several additional elements of this decision are important considerations for future land mobile services operating at these newly allocated frequency bands. In the interest of spectrum efficiency, channel spacing for these private mobile services, excluding public safety services, was reduced to 12.5 KHz.[38] SMR licenses for 900 MHz operations were initially available in the top 50 markets. In addition, Business and Industrial/Land Transportation services would eventually be allowed to share allocations, subject to certain conditions.

Perhaps the most novel feature of the decision was the creation of the General Purpose Mobile Service, open to all mobile service users including the land mobile community. While the specific operational characteristics of this service will be treated in a subsequent rulemaking proposal, the Commission has articulated a desire to develop a more flexible approach that would use market forces to apportion radio spectrum among the various mobile services. Among the important, and perhaps controversial, ideas mentioned in the context of this new service are that: (1) individual licensees should decide details of service use and system design; and (2) licenses may be assigned by auction. As recently as September 1987, the FCC denied a petition to reverse its decision to create this new service.

The FCC's proposal to further share the UHF-TV band generated much controversy outside of the land mobile radio industry. The broadcast interests clearly were not in favor of new arrangements to share vacant UHF-TV channels. Agreeing with the broadcasters' arguments that new sharing arrangements could diminish future advanced television implementation options, the FCC recently deferred further action on its 1985 sharing proposal.

New frequency allocations to land mobile services were not the only actions undertaken to alleviate growing congestion. The FCC has encouraged the use of new technology which makes more efficient use of radio spectrum than its predecessors. In 1985, after many years of developmental work, the FCC permitted the use of narrowband (5 KHz) technologies for private land mobile radio in the 150-170 frequency band.[39] In 1986, 12.5 KHz channel spacing was designated for private land mobile services operating in the 900 MHz frequency band, excluding public safety services. SMR systems, operating in this frequency band, were required to use channel trunking, which promotes radio spectrum efficiency.[40] With respect to cellular operations, the FCC has recently proposed to relax certain technical rules of operation to allow for more efficient and effective use of available radio frequencies.[41] By considering and implementing such technical developments, the FCC has sought to accommodate increasing numbers of mobile services users on the frequency spectrum assigned to land mobile services.

An additional way that the Commission promoted efficient use of allocated radio channels has been to encourage sharing among user categories. In 1984, for example, the FCC permitted the Business and Industrial/Land Transportation services operating in the 800 MHz band to share the use of those allocated frequencies, under certain conditions. SMR services, also at 800 MHz were allowed to join this sharing arrangement in 1987.[42] Users, lacking designated channels for a particular service area, may apply for licenses in other user categories -- allowing supply of channels to be adapted to market demand.

The Commission's allocation of land mobile reserve in 1986 was intended to meet the manifest needs of the land mobile industry. Some analysts have argued that in the private land mobile radio service, however, demand for radio channels in the major metropolitan areas may continue to exceed supply. Over 60,000 initial applications were filed for 900 MHz SMR systems in the top 50 markets, necessitating lottery procedures. In addition, over 2300 non-SMR applications were granted within 10 months of the 900 MHz allocation decision. With respect to cellular operations, the FCC is hopeful that technical improvements, aimed at increasing efficient use of radio spectrum, will permit demand to be adequately served by existing frequency allocations.

In addition to the frequency allocation decisions of the FCC, other decisions have had a substantial effect on the land mobile radio industry. Among the more important of these efforts have been activities in two areas, interconnection rules and service regulation.

Interconnection of land mobile radio services with the public switched telephone network was a very controversial issue long before 1961, when the non-wireline or radio common carriers reached agreements with the Bell telephone companies concerning interconnection. Prior to that historic agreement, non-wireline common carriers could not interconnect their mobile radio systems with local telephone facilities -- effectively limiting the competitiveness of non-wireline mobile systems.[43]

Over the last decade the Commission has developed rules, governing the interconnection of private land mobile services with the public switched telephone network, and it has modified public land mobile radio interconnection rules, in particular to accommodate cellular services. These actions, taken largely in response to industry and Congressional concerns, have allowed land mobile radio services to be integrated with the ubiquitous public switched telephone network.

Several private land mobile interconnection actions have been significant. In 1978, interconnection rules were adopted concerning private land mobile services operating below the 800 MHz frequency band.44 Four years later, the FCC addressed interconnection rules concerning private land mobile radio services operating above 800 MHz.45 In both of these instances, private paging services were prohibited from direct access to the public switched telephone network, without an intermediate person or device.

In 1982, Congress passed legislation which included a provision that private land mobile licensees could interconnect with telephone exchange and interexchange services, subject to minimal restrictions. As a result, the FCC subsequently removed interconnection restrictions on certain private services operation within 75 miles of the 25 metropolitan areas.46 In addition, private paging restrictions were also relaxed.47

With respect to the interconnection of radio common carriers with local telephone companies, the FCC has enacted rules during the last year, which address various disputes between the parties. These rules require local telephone companies to provide reasonable interconnection arrangements for non-wireline carriers who provide cellular, paging, and other common carrier services. The rules cover timely response to interconnection requests, the assignment of telephone numbers, and the types and cost of interconnection to be made available.48

The FCC has sought to ensure that its interconnection, user, and other policies have a maximal effect of land mobile radio development by asserting jurisdiction over states, with respect to rate and entry regulation. In 1986, the Commission ruled under the terms of the Communications Act, that state regulatory commissions could not regulate rates or entry of private land mobile radio service providers. The Commission has also preempted state regulation of interstate, public land mobile services.49

Major Trends and Issues

Demand for land mobile services has been growing steadily, while cellular and SMR services have undergone explosive growth. Despite the shift in the demographic composition of our national population, there is little reason to anticipate very dramatic changes in demand, in the near term. Indeed, cellular service providers will soon begin to deploy systems in new markets, including the most attractive smaller towns and along major transportation routes. The 900 MHz radio spectrum recently allocated to cellular services will allow additional subscribers to be accommodated in the densest urban markets. And technical innovation holds the promise of serving even more subscribers with a wider range of services, within the existing frequency allocations.50 With more subscribers, both subscriber equipment and service prices should continue to decline.

With the 900 MHz radio spectrum allocations to trunked SMR services, many additional users can be added to those already served by 800 MHz trunked services. And intercategory sharing within these frequency bands will help shape the supply of radio channels according to market demand. Both service and equipment prices can be expected to decline as competition grows in the manufacture of 900 MHz trunked systems.

Both paging and conventional private land mobile radio services should continue steady growth with the new allocations in the 900 MHz band. Public paging services have been allocated 40 additional channels, including three channels for nationwide paging. And paging services can be offered either privately over 20 channels or on a commercial basis (also over 20 channels) to those eligible for private paging services. Dramatic future growth of conventional private land mobile radio services may depend somewhat upon activities in three areas: Technical improvements which reduce channel bandwidth requirements, increased use of channel trunking or the allocation of more radio spectrum to these services.

Various land mobile radio issues of the past are not likely to completely disappear in the near future. Among the important future concerns will be radio spectrum allocation and license assignment issues. Such issues include not only whether land mobile services will receive new radio spectrum allocations, but how the radio spectrum will be allocated and what new allocations will be made among public and private services users. Equally important considerations will include how license assignments are made and how much use flexibility will be allowed with each license.

Basic Radio Spectrum Allocation Decisions

Both the users and uses of radio spectrum are growing dramatically. Broadcasters are planning to implement advanced television technology which exceed present television broadcasting bandwidth requirements. Fixed satellite service applications are now well-established. New mobile satellite services are under development. Microwave radio systems are growing rapidly, as is the proliferation of radio emitting devices, such as microwave ovens, new lighting systems and other electronic technology. All of these developments depend upon the availability of sufficient radio spectrum and compete with land mobile radio interests.

Land mobile radio services will continue to compete with both communication and non-communication services, for new radio spectrum allocations. Continuing growth in demand for land mobile radio services will almost guarantee that such competition will become no less intense in the future.

The Allocation of Radio Spectrum Among Land Mobile Services

Radio spectrum has been allocated to land mobile services, by the FCC, in a variety of ways, each suiting a different purpose. Prior to the 1970's, the FCC allocated radio frequencies to user groups in both the public and private land mobile radio services. Using this allocation scheme, explicit choices were made to enhance the development of particular land mobile radio uses. In 1974, with the Docket No. 18262 decision, the Commission used an allocation scheme for new radio frequencies, based upon the system technology used. With this approach, the FCC sought to encourage development of mobile services, using technologies that were more spectrally efficient than their predecessors. In the more recent 900 MHz allocation decision, the FCC partially reverted to an earlier allocation notion by making private radio frequency allocations by user type, while also allocating radio frequencies to technology-defined, cellular operations and trunked SMR systems.

Through adoption of these various allocation schemes, the FCC has attempted to find a balance between encouraging services based upon particular technologies and identifying appropriate private users of radio spectrum. In addition, the Commission has found it useful to adopt more flexible allocation rules. Provisions have been made for intercategory sharing in private land mobile radio channels in the 800 MHz and 900 MHz frequency bands. The Commission's apparent need to balance technical and user development objectives will be a likely dimension of any future decisions which allocate radio frequencies within the land mobile industry.

License Assignment Procedures

Licenses for specific land mobile services, in particular areas, are assigned in several ways. Traditionally, in situations in which license applications exceed the supply of channels available for a specific service, the Commission has relied upon comparative hearings to determine which applicant would be granted that license. With the overwhelming interest of providers of both cellular and SMR services in deploying such systems in more markets, the Commission currently employs, where necessary, a lottery selection procedure to award certain cellular licenses and a waiting list procedure for SMR licenses. A third license assignment idea, assignment by auction, has recently been suggested in the context of the newly-established General Purpose Mobile service. Under such an approach, the awardee, presumably the highest qualified bidder, would have the ability to determine the service offered and the technology used.

Uses of Land Mobile Radio Services

The long-standing distinctions between public and private services may continue to blur in the future. Traditionally, public services were offered to all users. Private services were operated by specifically-identified users in conjunction with the conduct of their everyday activities. The creation of SMR services allowed commercial operators to provide mobile radio services to these private users. And interconnection to the public switched telephone network by private services has made the similarities between public services and SMR services ever stronger.[51]

The historic distinctions in channel allocation categories, based upon use of radio channels, may also continue to blur. In the SMR services, recent provisions allow users to employ additional frequencies, when radio channels assigned to their user categories are filled. In 1985, the FCC relaxed rules on the types of communications permitted by private radio users, offering greater operational flexibility.[52] In a proceeding still pending, the FCC has proposed to allow cellular operators to offer services other than mobile telephone services.[53] One of the most provocative and, without doubt, controversial ideas in this docket, is the proposal to relax certain technical standards for cellular service operations in the interest of promoting more efficient use of the radio spectrum. While the proposal, if adopted, would allow operators to install innovative cellular technology, potential equipment incompatibility could interfere with the interoperability of systems.

The development of land mobile radio services has been profoundly shaped by evolving demand for services, technical advances, and regulatory decisions involving spectrum allocation, licensing procedures, and industry structure. These factors will continue to drive industry development.

Notes

1. NTIA Special Study Staff, NTIA Competition Benefits Report, November 1985, p. 72.

2. The type of application and other characteristics of the messages carried will affect channel loading specifications. Because of traffic engineering considerations, a radio channel can accommodate more users with short message applications than possible with users whose messages have long transmission durations. For instance, fewer mobile units can be served by a radio channel carrying dispatch communications than tone-only paging; even fewer mobile units can be served by a radio channel carrying telephone conversations than dispatch communications. Second, multichannel, trunked radio systems can accommodate more users per channel than single channel systems. Thus, radio systems having five channels can serve many more than five times the mobiles served on five single channel systems, because of "trunking efficiencies." Finally, the FCC differentiates services on the basis of user types. It typically specifies fewer mobiles per channel for public safety applications than for business or industrial radio, presumably to reduce the possibility of channel congestion in safety applications. Based upon such factors, the FCC has established land mobile service categories and channel loading criteria.

3. 47 USC Sec. 153 (gg) (Supp. II 1984).

4. While the FCC has restricted further development of dispatch services related to these common carrier frequency assignments, common carriers operating dispatch services prior to 1982 may continue to provide such services. 47 CFR Sec. 22.519 (a) (1984).

5. Cellular radio systems have two features which permit them to use radio spectrum very efficiently. By employing relatively low-power transmitters, cellular systems are able to reuse transmitter frequencies within a local market serving area. In addition, these systems employ multichannel trunking technology which also increases the spectral efficiency of such systems.

6. The cellular service industry added its one millionth subscriber in October, 1987. Obviously, current growth rates will level, somewhat, after the industry completes this initial implementation phase.

7. Among the cellular systems operating in more than 30 countries, the current U.S. subscribership totals almost one-half of the world cellular radio subscribership.

8. Motorola and AT&T supplied system equipment for seventy percent of the first 200 cellular operations. Northern Telecom and Ericsson were the next largest suppliers with 12 percent and 11 percent of this market respectively.

9. A particular cellular service has been growing in popularity. "Roaming" activities, which involve telephone calls placed by a mobile user outside of his home service area, already account for up to 20 percent of total service revenue for some of the larger systems. For the first-half of 1987, roaming revenues have been estimated to be about $55 million, or 11.5 percent of total industry service revenues for that period.

10. "Hello Anywhere," Business Week, Sept. 21, 1987, p. 84.

11. Vehicular telephones are typically mounted in automobiles or trucks. Transportable telephones are somewhat smaller and often carried in a briefcase. Portable telephones are designed to be very compact and hand-carried.

    Only three U.S. companies are among the top ten manufacturers of cellular telephones. Motorola has the greatest market share, while General Electric and E.F. Johnson have much smaller shares of this market.

12. Vehicular telephones are expected to be typically priced at $200-$500 by 1990.

13. One consultant predicts that one-third of all cellular telephone sales will be for portable units by 1990. See 1987 Electronic Market Data Book, Electronic Industries Assn., 1987, p. 45.

14. "On the Road but Just a Beep Away," Insight, Sept. 28, 1987, p. 43.

15. "Telocator Bulletin," 6/6/86, p. 5.

16. In 1984, the FCC allocated 40 additional channels to public paging services. Three of these forty channels were designated for nationwide paging services, with licenses to be awarded by lottery to network organizers.

17. The third network organizer for nationwide paging service allowed its construction permit to expire.

18. Telocator Magazine, September-October 1986, p.89.

19. These frequency bands include 30-50 MHz, 150-170 MHz, 450-470 MHz, 470-512 MHz, 800 MHz and 900 MHz bands.

20. "Telocator Bulletin," 6/6/86, p.5. Also see 1987 Electronic Market Data Book.

21. For an interesting historical discussion, see Daniel Noble, "The History of Land Mobile Communications", Proceedings of the IRE Vol. 50, No. 5 (May 1962), p. 1407.

22. Of course, the federal government is a very large user of radio spectrum for a variety of services, including land mobile radio services. These activities are discussed in a separate paper.

23. By 1937, 29 radio channels were added to the 34 channels already established for police mobile communications.

24. In 1945, the FCC allocated radio frequencies for the Railroad Radio Service, the General Mobile Radio Service, and the Citizens Radio Communications Service. The General Mobile Radio Service consisted of Bus, Truck, and Taxicab Radio Services, and the Common Carrier Mobile Radiotelephone Service. The Citizens Radio Communications Service, not related to the current Citizens Band Service, never developed as originally proposed.

25. For the provision of common carrier services, the FCC established separate sets of radio frequencies for wireline and non-wireline carriers.

26. Up to this point, the FCC's traditional concerns involved safety of life or property.

27. Frequency modulation (or FM) receivers have the ability to suppress noise and to "capture" the strongest signal among many transmitted signals.

28. Between 1955 and 1960, the FCC conducted eight rulemakings to reduce radio channel spacing and to assign these newly-available channels.

29. See Notice of Proposed Rulemaking, FCC Docket No. 18261 and Notice of Inquiry and Notice of Proposed Rulemaking, FCC Docket No. 18262.

30. This conflict between land mobile and broadcast interests was not new. Two decades earlier, the FCC allocated radio frequencies for use by the television broadcast service, over the competing claims of mobile radio interests.

31. This proceeding lasted a total of six years. The shared channels actually became available to Land Transportation, Industrial, and Public Safety services in 1971. In 1974, private land mobile users in three additional metropolitan areas were allowed to share such vacant UHF-TV channels.

32. The 800 MHz band refers to radio spectrum in the 806-821 MHz and 851-866 MHz bands.

33. The FCC later divided this allocation equally between wireline and non-wireline carriers.

34. Of the remaining 13 MHz of reserve, 3 MHz were assigned to paging services. Both public and private paging services each received 40 channels (i.e., 1 MHz), while 1 MHz became reserve. The other 10 MHz was

allocated to other uses including broadcast auxiliary, private operational fixed, and other fixed services.

35. Notice of Proposed Rulemaking, FCC General Docket No. 85-172.

36. Notice of Proposed Rulemaking, FCC General Docket No. 87-14. In August 1988, the FCC allocated the 220-222 MHz band for narrowband land mobile service.

37. The 900 MHz bands refer to 896-901 MHz and 935-940 MHz. Amid the positions of various industry segments, was a 1983 request from the Congress that the FCC develop a plan which considered the need for a nationwide contiguous frequency allocation for public safety purposes.

38. These new radio channels are to be one-half of the width of the 800 Mhz private mobile radio channels.

39. FCC Private Radio Docket No. 84-279.

40. In 1987, the FCC began an inquiry into the use of trunking throughout the full range of private land mobile radio services, to promote more efficient and effective use of the radio spectrum.

41. Notice of Proposed Rulemaking, FCC General Docket No. 87-390.

42. FCC Private Radio Docket No. 86-160.

43. Of course, wireline carriers had no problem interconnecting their mobile services with their landline telephone services.

44. First Report and Order, FCC Docket No. 20846.

45. Second Report and Order, FCC Docket No. 20846.

46. Report and Order, FCC Private Radio Docket No. 84-414, adopted 1985.

47. Memorandum Opinion and Order, FCC Docket No. 80-183, 1983; Report and Order, FCC Private Radio Docket No. 86-335, adopted 1987.

48. Interconnection arrangements with interexchange carriers are not covered by these rules.

49. The FCC preempted state entry regulation of public land mobile services in 1986. The U.S. Court of Appeals later ruled that the FCC had exceeded its authority with respect to intrastate common carrier mobile services. In 1987,

the FCC clarified its position, asserting jurisdiction over interstate common carrier mobile services.

50. See the discussion of future cellular technology described in Report and Order, FCC General Docket No. 84-1231, FCC General Docket No. 84-1233, FCC General Docket No. 84-1234, adopted July 24, 1986, paragraphs 21 through 24. Also see discussion of cellular paging and dispatch services discussed in the Notice of Proposed Rulemaking, FCC General Docket No. 87-390, released September 17, 1987.

51. A recent proposal to allow wireline carriers to offer SMR services will make similarities even stronger. See Notice of Proposed Rulemaking, FCC Private Radio Docket No. 86-3.

52. FCC Private Radio Docket No. 84-109.

53. Notice of Proposed Rulemaking, FCC General Docket No. 87-390, adopted September 19, 1987.

VI

Telecommunications Network and Customer Premises Equipment

by Joseph F. Kellagher

The telephone equipment market consists of two major categories of equipment, customer premises equipment and network equipment. The level of technology and regulatory treatment of this industry has created these two generic categories. Customer premises equipment (CPE) is telephone equipment purchased by and for the use of a consumer or end-user. Examples of CPE are telephone handsets, key systems, private branch exchanges (PBXs), modems, facsimile machines, telex terminals, and videoconferencing equipment. Network equipment consists of all the equipment in a telecommunications system that provides the communications path between end-users or CPE devices. The most common network equipment products are central office switches, packet switches, multiplexers, and carrier line equipment.

The convergence of communications and computer technologies has blurred traditional product lines in the telephone services and equipment fields. No single delineation of the telecommunications marketplace today is universally accepted because existing classifications tend to be both under- and over-inclusive. Some U.S. trade experts define "telecommunications products" to include all of Standard Industrial Classification (SIC) 3661 (Telephone and Telegraph Equipment) and about 30 percent of SIC 3662 (Radio Communications and Detection Equipment). However, SIC 3662 includes transmission products used by both the telephone companies and the broadcast industry, all forms of military radar, and even traffic signal control systems. Telecommunications industry equipment is usually described as all the equipment in the traditional voice telephone network and microwave antennas, satellites, earth stations, fiber optic equipment and cable, receivers, transmitters, transceivers, and other radio equipment including cellular mobile radio.

Key Industry Statistics

Telecommunications Equipment -- Customer Premises[1]

Sales of customer premises equipment totaled about $20 billion in 1986 according to a consulting firm, Frost and Sullivan.[2] U.S. product shipments of customer premises equipment totaled $5.2 billion in 1986, a 22.5 percent drop from 1985 shipments.[3] This drop in domestic shipments came at a time when overall U.S. demand dropped only slightly over a two year period. The difference reflects our use of sales figures (value installed) versus domestic manufacturer-supplied shipment statistics (value shipped), plus some difference in the products included in this category. Value installed is typically twice value shipped, especially in the case of commercial communications installations, and there are few, if any, consistent equipment categories employed in this or, for that matter, many other communications equipment markets.

The competitive and trade characteristics of the various categories of customer premises equipment vary widely. In general, however, the more costly and sophisticated a given product, the more likely it is that it will be produced (or at least assembled) in the United States. The CPE market drop has led to increased competition among the numerous suppliers, both domestic and foreign. Imports of foreign products captured an increasingly larger share of individual product markets. This intense competition has increased the pressure on profit margins by forcing price cuts and discounting.

Roughly 2,000 "interconnect" companies retail customer premises equipment in the United States. This number is beginning to drop as equipment manufacturers have begun to purchase distributors and retail establishments to develop stronger distribution networks. New distribution patterns are also developing, with more manufacturers creating direct sales forces rather than relying on retail establishments or distributor networks. Most CPE products are purchased from interconnect companies, the Bell Operating Companies' retail/lease departments and supply houses. They can also be purchased from the independent telephone companies, business communications stores and other retail/wholesale distributors.[4]

The drop in the CPE market is expected to continue into 1988 with U.S. product shipments forecast at $4.9 billion, 4.0 percent below 1987 levels.[5] Some foreign producers not yet well entrenched in the U.S. market are establishing distribution networks and limited assembly/manufacturing facilities in their attempt to gain market share in the U.S. CPE market.

Telephone Handset Market. The telephone handset market, deregulated by the FCC in 1980, accounted for about $1.1 billion in sales in 1986, compared to $1.4 billion in 1985. U.S. product shipments for telephone sets totaled $784 million in 1986, a drop in domestic production of about 36 percent from 1985. Handset sales increased to about $1.2 billion in 1987, reflecting some growth in the feature, cordless, and two-line telephone markets. The standard, disposable and decorator telephone markets fell in 1987. The average price increased slightly in 1987 to $66 per handset. The number of units sold in 1987 totaled 30 million. There are an estimated 250 million commercial and residential telephone handsets in use in the United States today. Residential telephones account for about three-quarters of the installed base. In the United States, over 86 million households are equipped with a telephone, averaging 2.2 units each.

Far East manufacturers dominate this market, accounting for three-quarters of the products sold. Another 15 percent are supplied from U.S. company subsidiaries in the Far East. Since the early 1980s, residential handset manufacturing has increasingly moved overseas, chiefly because of substantially lower labor costs. AT&T, Alcatel, Comdial, GTE, and Northern Telecom still produce residential and/or business handsets in the United States.

Comdial, with less than one percent of the telephone set market, and Northern Telecom are the only companies now producing handsets domestically for the residential market. Both companies use almost all domestically-produced components. All of AT&T's residential handset manufacturing operations have been moved overseas since 1986.[8] GTE and Fujitsu signed an agreement in 1987 under which Fujitsu will acquire majority interest in GTE's customer premises equipment operations. It is expected that this joint operation will still make some business handsets here. ITT merged all of its offshore and some of its domestic communications manufacturing operations with Alcatel, a subsidiary of the French government-owned CGE, now operating under the name Alcatel NV. It is presently unknown whether Alcatel will continue to produce either ITT's domestic business and residential handsets or their own models in the United States.

The number of telephone handsets is expected to increase by only 2.2 percent through 1990 to 30.2 million units. Feature, two-line, and cordless telephone sales will lead the market, while disposable and decorator telephone sales will drop sharply. Standard telephone set sales will drop slightly to 9.2 million units by 1990, but still will account for 30 percent of the market. Prices are also expected to fall slightly in this same period. The emphasis will be for consumers to purchase standard telephones with optional, do-it-yourself add-ons, such as: speakerphones, automatic-dialers, data modules, and answering machines.

Key System Market. Key telephone systems are more sophisticated, multi-line business communications installations. They bridge the market between single-line, chiefly residential customers, and larger communications users with sufficient traffic to warrant installing a PBX. Key system sales in 1986 were about $2.5 billion, virtually the same as 1985 sales. This sector is facing market saturation and the increasing competitiveness of phone company offerings such as Centrex. (U.S. product shipments for key systems are combined with other equipment in a "basket" category and cannot be isolated.)

AT&T currently is estimated to have about one-fourth of the total key system market, though it generally has a larger market share with respect to larger key telephone installations. AT&T captured about 22 percent of the one to 24 station key system market, a 33 percent share of the 25 to 48 station market, and a

32 percent share of the over-48 station portion of the market.[7] See Table 1 for market share distributions. Competition, however, is intense and this is reflected in steadily declining prices. Prices are projected to fall, for instance, from about $225 per station in 1985 to about $160 per station by 1990.[8] The telephone equipment retailing subsidiaries of the Bell companies are substantial and growing competitive forces in the key system market. Bell company subsidiaries, however, currently market no AT&T key systems or related products.

TABLE 1
U.S. Key System Market Shares (1986)[9]

Firm	Estimated Share (%)
AT&T	24.2
TIE	21.4
Toshiba	8.6
Iwatsu	6.6
Matsushita/Executone[10]	5.9
NEC	4.0
Isoetec	3.0
Trillium	3.0
Vovadi	3.0
Others	20.3

Source: Salomon Brothers Inc., Northern Business Information, and Dataquest Inc.

Foreign-based firms today enjoy about half the U.S. key system market and virtually all of the products they market here are manufactured abroad, increasingly in South Korea. Bell companies today retail key telephone systems manufactured by others, but none of these companies has yet secured a large national market.

The installed base of key systems should reach 30 million lines by year-end 1987, or 4.8 million units. The key system market should remain flat through 1990 with sales of $2.4 billion that year. Line shipments, however, should increase from 4.4 million in 1987 to 4.5 million in 1990.[11] Falling prices through this period account for the drop in revenues.

Private Branch Exchange (PBX) Market. The most commercially important and technically sophisticated part of the customer premises equipment market is the PBX market. PBXs are switches located on the customer premises and used increasingly, in addition to handling telephone traffic, for other kinds of business communications including all forms of data traffic. There are about 240,000 PBXs installed in the United States today, and the market has been growing until recently at a rate of about 15 percent compounded each year. U.S.

PBX sales in 1986 totaled over $3.7 billion, up only one percent from 1985 sales.[14] The U.S. Bureau of the Census recently reported total 1986 manufacturer product shipments valued at about $854 million, a substantial drop in domestic production from the $1.7 billion in 1985.[15] Digital voice PBXs accounted for 84 percent of sales in 1986, digital voice/data PBXs accounted for 9.6 percent and analog voice PBXs for 6.0 percent. PBX line shipments, for both voice and data, increased from 5.4 million lines in 1986 to about 5.5 million in 1987. The dollar value of sales actually dropped about 5.4 percent to $3.5 billion in 1987. Five companies -- AT&T, Northern Telecom, IBM's Rolm subsidiary, British Telecom's Mitel subsidiary, and NEC -- currently account for about 75 percent of the U.S. PBX market. See Table 2.

TABLE 2
U.S. PBX Voice and Data Line Shipments (1986)

Firm	Estimated Share (%)
AT&T	21.4
Northern Telecom	19.4
Rolm	15.4
Mitel	9.6
NEC	9.5
Others	24.7

Source: Dataquest Inc., Communications Week, November 16, 1987

Because PBXs are regarded as the potential "hubs" of tomorrow's "electronic office," competition in the PBX market has intensified in recent years. A number of firms that are also major suppliers of electronics-based office equipment, Japan-based firms especially, are seeking to capture market share. Germany's Siemens AG also has made major efforts to penetrate the U.S. PBX market. Reportedly the company planned to spend $300 million in 1987 marketing its PBX and small central office switch product lines here. The telephone equipment retailing subsidiaries of Bell companies today are among the largest PBX distributors, and among the largest distributors of PBXs produced by foreign-based firms. Bell subsidiaries, again, currently market no AT&T PBXs.

Virtually all of the multinational corporations now active in our PBX market have some manufacturing facilities in the United States. It has not been possible, however, to precisely determine the extent of U.S. labor content or value added. Certain U.S. "manufacturing" facilities produce PBXs here primarily using components, subassemblies, and assemblies imported from abroad. Others, however, are more integrated and produce many of the items required for final assembly in this country. Complicating the task of determining domestic labor content or value added is the fact that the software incorporated in increasingly sophisticated PBXs is not generally unbundled.

Primary PBX market customers are larger business communications users which employ such switches as part of their overall communications (and, increasingly, data processing) systems. These customers can be divided into two groups. The first are the very largest firms, chiefly major multinational corporations. They typically have substantial in-house communications expertise and thus the ability to piece together systems using equipment supplied by a number of firms. The second group, however, consists of large to medium-sized corporate, educational, or government communications users. They may not now have the in-house resources to facilitate "piece-part" procurement of communications equipment, circuits, and services. This second group thus often prefers to deal with vendors able to offer "one-stop shopping" or a "system solution." For this group, price may be less of a factor than convenience, reliability, and the ready availability of maintenance, repair, and upgrading services.

Centrex is the generic name for a range of business communications services that provide PBX-like functions and features. The telephone companies offer these centrex services, which are provided by dedicating a group of lines and a portion of a central office switch to a single customer, so that business customers do not have to purchase and maintain their own communications equipment and networks. Centrex services directly compete with PBX equipment. The installed base of centrex was estimated at 6.9 million lines in 1987. The Bell Operating Companies accounted for 5.9 million and the independent telephone companies had 1.0 million lines.[14]

The Bell Operating Companies are investing heavily in developing new features and agressive marketing and pricing of centrex services. The software development efforts are narrowing the technical edge PBXs presently hold over centrex. The two are nearly equal in data communications, networking, and specialized functions such as voice and electronic mail.[15] The greatest potential market for growth is in the smaller business market with less than 125 stations. Larger corporations typically operate in areas served by the different Bell Operating Companies and independent telephone companies, making coordination of centrex services more difficult. The introduction of digital centrex as the gateway to integrated services digital network technology and the possible deregulation or detariffing of centrex by individual states should prove to enhance centrex's marketability. However, the line-of-business restrictions of the Modified Final Judgement may inhibit the development of further centrex enhancements because the Bell Operating Companies are prohibited from offering information services. The North American Telecommunications Association forecasts centrex growth of 3.9 percent annually through 1991.

PBX sales are expected to fall five percent between 1987 and 1990.[16] The PBX market is essentially a replacement market and the replacement cycle won't begin until about 1990. In 1990, digital voice/data PBXs are expected to capture about 30 percent of the $3.0 million PBX market versus 68 percent for digital voice and two percent for analog voice PBXs.[17] Price per line will drop to $700 per line for voice/data models compared to $900 presently.[18] Consolidation among the other 20 or so manufacturers (outside the top seven) or withdrawal from the market is inevitable as profit margins remain tight in this highly competitive market. Many of these smaller manufacturers are seeking niche markets for specialized applications of their PBXs.

Other Terminal Equipment Markets. In addition to terminal equipment used for voice communications, there is a significant class of non-voice communications equipment, much of which is manufactured abroad. The U.S. facsimile equipment market, for example, generated about $560 million in 1986 sales with sales doubling in 1987. Virtually all facsimile machines sold in the United States today are produced abroad. Modems, or devices which facilitate data communications, are expected to account for about $1.3 billion in sales in 1987, 14 percent above 1986 sales.[19] Expected price reductions should keep revenues dropping despite healthy growth in modem shipments. While a majority of modems appear to be assembled in the United States, a substantial percentage of the components evidently are produced overseas. Expected price reductions should keep revenues dropping despite healthy growth in modem shipments. There is, in addition, a significant and growing market for answering machines, as previously indicated. Some 5.8 million such units, with a retail value of about $500 million, were sold in the United States in 1987.

Telecommunications Equipment -- Network

The term "network equipment" generally is considered to encompass the transmission and distribution facilities, including central office switching apparatus, comprising the nationwide regulated telephone network. This network today consists of some 22,500 telephone central office installations (of which about 9,700 are owned by the Bell companies), more than three billion circuit miles of engineered and in-service transmission capacity, and about 124 million access lines connecting telephone service customers to traffic concentrators and switching offices. Typically, switching equipment represents approximately 50 percent of total telephone industry investment. Overall, the national network operated by the regulated telephone companies constitutes a capital investment substantially exceeding $230 billion. In addition, large communications users and particularly the Federal Government, have substantial investments in transmission and switching equipment, for the most part interconnected with the public switched telephone network.

The overall U.S. domestic network equipment market continued to expand in 1987. Industry shipments were expected to rise almost 12 percent to about $14.4 billion, according to Commerce Department estimates. Shipments of central office switching equipment were valued at about $5.1 billion in 1987, down about four percent from 1986. Shipments of multiplexing equipment grew over 20 percent to $1.8 billion. Carrier line equipment shipments were expected to rise 16 percent in 1987 to about $1.6 billion.[20] Transmission systems were also expected to show sizeable increases. Comparable increases occurred abroad, reflecting not only the rapid growth of telecommunications services generally, but also the ongoing industry shift from traditional analog switches to new digital apparatus.

Expenditures by U.S. telecommunications carriers for equipment and building construction are expected to drop slightly in 1988 to $24.6 billion from $24.5 billion in 1987. The Bell Operating Companies are expected to maintain their expenditures at the 1987 level of $14.1 billion. The independents spent $5.8 billion, some three percent below 1987, and the interexchange carriers, including AT&T, will increase expenditures two percent in 1988, from $4.5 billion in 1987 to $4.6 billion.[21] Purchases of new digital equipment, especially digital central office switches and equipment, data communications switches, signal transfer points, channel banks, multiplexers, and fiber optic cable and connectors, will account for an increasingly higher share of construction and equipment expenditures in 1987. Construction expenditures remained steady in 1987 since many of the new buildings necessary for new central office switches have been completed. An increasing percentage of competitive carrier network spending went for switching and related products made by foreign-based firms.

Central Office Switch Market.[22] In 1987, central office (CO) switch equipment manufacturers shipped an estimated 13.4 million lines of digital CO equipment, a slight drop from 1986 shipments.[23] U.S. product shipments of CO switches were estimated at $5.1 billion in 1987, four percent below 1986.[24] The central office market is almost entirely a replacement market. The installed base of central office switches in the United States totaled roughly 22,500 units in 1987. AT&T and the Bell Operating Companies (the complete Bell System prior to divestiture) had an estimated 9,708 CO switches in service in 1986, 32 percent of which were analog, electronic switching systems (See Table 3). Almost 18 percent were digital and the remainder were electromechnical. Table 4 lists the Bell Operating Companies' 1985 and estimated 1986 CO switch installations.

TABLE 3
Installed Base of CO Switches (1986)

Telephone Company Group	Units
AT&T and the BOCs	9,708
GTE	2,300
Other Independents	8,232
REA	1,000
Other	1,260
Total	22,500

Source: NTIA.

The installed base of the independent telephone companies totaled over 10,532 CO switches in 1986.[25] The independent telephone companies have a much higher installed base of digital central office switches than the BOCs because many converted directly from electromechanical to digital. GTE Corporation is the largest of the independents and in 1986 had an installed base of about 2,300 CO switches.

TABLE 4
Regional Bell Operating Companies' Central Office Switch Installations and Access Line 1985 and 1986 (Estimated)

Company	Access Lines Installed (Million)	Electro-Mechanical 1985	Electro-Mechanical 1986	Electronic Analog 1985	Electronic Analog 1986	Digital 1985	Digital 1986	Total 1985	Total 1986
AMERITECH									
Illinois Bell	4.8	125	108	142	137	36	76	303	321
Indiana Bell	1.45	96	89	59	59	9	16	164	164
Michigan Bell	3.8	207	186	144	143	23	46	374	375
Ohio Bell	2.96	133	99	94	91	32	65	259	255
Wisconsin Bell	1.53	46	26	65	64	21	41	132	131
BELL ATLANTIC									
C&P Telcos	5.92	381	219	243	241	96	202	720	662
Bell of Pa	4.62	184	111	139	133	80	159	403	403
Diamond State	0.337	3	0	14	14	16	20	33	34
New Jersey Bell	4.2	72	55	118	117	24	37	214	209
BELLSOUTH									
Southern Bell	8.08	255	215	273	256	119	181	647	652
So. Cent. Bell	6.42	601	568	291	283	69	109	961	960
NYNEX									
New York Tel	8.69	379	331	236	232	86	140	701	703
New Eng. Tel	4.8	519	456	92	92	71	104	682	652
PACIFIC TELESIS									
Pacific Bell	11.52	351	322	302	301	81	108	734	731
Nevada Bell	0.155	16	13	14	13	12	16	42	42
SOUTHWESTERN BELL									
Southwest Bell	10.9	810	716	438	431	63	170	1311	1317
U.S. WEST									
Mountain Bell	5.17	582	549	193	189	34	76	809	814
NW Bell	3.41	503	487	135	133	20	39	658	659
Pacific NW Bell	2.59	175	120	81	78	14	69	269	267

Source: Communications Week, March 17, 1986

The Rural Electrification Administration (REA) helped fund an additional 1,000 switches now in service in rural areas through 1986 and a total of 1,473 by year-end 1987.[26] Private networks of the government, military, and private corporations, and other long distance carriers accounted for the remaining number of switches.

The Bell Operating Companies, the independent telephone companies, and the interexchange carriers are all modernizing their networks. The September 1986 equal access deadline encouraged the telephone companies to install new digital CO switches because they offered the easiest conversion to the equal access connections for the long distance carriers. As of year-end 1987, about 37 percent of the network access lines in the United States are expected to be digital compared to 27 percent in 1986. The independent telephone companies lead in digital installations with over 50 percent of their access lines being digital, while the Bell Operating Companies' access lines are only about 33 percent digital.[27]

AT&T has always dominated the CO market in the United States. In 1986, AT&T accounted for 45 percent of the 14.7 million analog and digital lines shipped. Northern Telecom captured about 38 percent and GTE placed third with 13 percent of the lines shipped. The other manufacturers accounted for about four percent of the CO market.[28] AT&T and Northern Telecom are expected to again capture over 85 percent of the CO market in 1987.

AT&T and GTE Corporation announced an agreement in principle in mid-July 1988 to form a network switching joint venture. This joint venture would upgrade GTE's digital central office switching lines and provide long-term support and enhancements for these CO switches. GTE is expected to maintain 51 percent ownership in the venture, and after five years, AT&T would increase its share to 80 percent. This venture does not include the GTE-Siemens joint venture involving GTE's international switching operations.[29]

Northern Telecom Inc., a subsidiary of Bell Canada Enterprises, and AT&T are the principal suppliers of all categories of switching equipment to the Bell companies today. GTE sells chiefly to its local telephone companies, which represents about nine percent of the nation's 124 million access lines and 250 million telephones.

The Bell Operating Companies are encouraging competition to lower prices, obtain better equipment and technologies, and gain more leverage in equipment procurement. Manufacturers have responded to the Bell Operating Company interest with large financial commitments to develop hardware and software. While most of the newer entrants to this market do not expect to overtake the two switching giants, they nonetheless have implemented development and marketing plans that may allow them to capture a small, but sizeable share of the U.S. switching market.[30]

Several foreign companies moved outside their home markets long ago to test their sales and marketing skills in the international arena. Among these companies are: LM Ericsson Telephone Company, Sweden; Alcatel NV, France and Belgium; Siemens AG, West Germany; Plessey, U.K.; Fujitsu, Japan; and NEC Corporation, Japan. All these companies have sales and distribution networks, and even some manufacturing facilities in the United States.

The increased competition in the U.S. market from the expansion of these foreign companies has caused some corporate realignments. In early 1987, the telecommunications division of ITT was sold to Alcatel of France to form the second largest telecommunications equipment manufacturer in the world, Alcatel NV. In February, 1986, ITT announced the cancellation of its plans to develop and market a U.S. version of its European switch. Delays in software development inhibited ITT's efforts to gain early penetration in the U.S. market. This decision resulted in a layoff of 1,600 people in its U.S. operations and the loss of $165 million in R&D efforts. GTE Corporation also recently sold majority control of its overseas switching and transmission systems operation to Siemens AG. DSC Communications Corporation and ITEC, Inc., both domestic suppliers of central office switches, dropped out of the Class 5 central office switch market because of intense competition and the large financial drain of maintaining competitive products with the worldwide leading equipment manufacturers.[3]

Competition among world-class equipment manufacturers has focused on this equipment submarket and switch prices have steadily declined, partly due to this competition (from about $1,000 to about $300 per line or less over the past four years). Switching equipment sales are especially attractive, since initial sales also tend to lead to further sales downstream as equipment is repaired, modernized, or its capacity expanded. This, plus the fact certain switch types and brands are technically incompatible, tends to affect competition in the field.

Foreign-based telecommunications equipment firms which manufacture here (chiefly Northern Telecom) have a significant share of the U.S. market, as shown in Table 5, below. But, the only U.S.-based CO switch manufacturer now aggressively seeking sales abroad is AT&T.

TABLE 5
1985 Digital Lines Placed
in Service Worldwide

Firm	Lines (%)
Northern Telecom (Canada)	25
AT&T (U.S.)	21
Alcatel (France)	14
GTE (U.S.)	8
Ericsson (Sweden)	8
NEC (Japan)	8
Siemens (West Germany)	6
ITT (U.S.)	4
Other	6

Source: NTIA

Foreign-based switch suppliers have been successful in selling products to Independent phone companies and the competitive common carriers. They are aggressively seeking Bell company sales but have achieved limited success to date. The largest competitive carrier, IBM's affiliate, MCI, has bought its switches from Ericsson, Fujitsu, Digital Switch (DSC Communications Corporation), and Northern Telecom. Foreign-based suppliers are also principal suppliers to U.S. rural telephone companies, in part as a result of Plessey's acquisition of General Dynamic's Stromberg-Carlson subsidiary, a longtime supplier to this small part of the overall switch market.

Siemens maintains a high profile in the United States with over 24,000 employees, $1.3 billion in investments, and $2.2 billion in revenues. Its communications division employs 6,200 people. Siemens has sold its digital central office switch to at least four BOCs and is participating in ISDN trials with Southwestern Bell. The company has dedicated a new research center in Florida solely for work on its central office switch, employing 500 people. Siemens is also converting a portion of its packet switch manufacturing facilities to handle some manufacturing of its CO switch.

Ericsson is working from a smaller base in the United States with one-third the investment of Siemens. However, this company has made great strides in the CO market. Ericsson has proposed some joint development projects with the various Bell Operating Companies and plans to sell 100,000 lines of its CO switch equipment in 1987. Ericsson scored its biggest contract in April 1987 when U.S West agreed to buy 52 switches to be used in rural Idaho. Ericsson has also had success with other Bell Operating Companies in selling a specialized version of its CO switch as signal transfer points and in selling cellular mobile radio systems, incorporating the CO switch.

Stromberg-Carlson, owned by Plessey of the United Kingdom, traditionally has sold to the small independent market. However, in April 1987, Stromberg signed an agreement with BellSouth to supply 600,000 lines of equipment -- a $100 million contract. Stromberg's success may position the company to expand into other BOC markets.

Major Demand Factors. The Bell companies, in aggregate, represent about 80 percent of U.S. demand for all switching apparatus. Non-Bell telephone companies and a few large corporate communications users constitute the balance of the demand side of the market. Data regarding their 1985 procurement which the Bell Operating Companies supplied NTIA (the latest available data) indicates about 52 percent of Bell Operating Company total procurement went for switching. Foreign-based firms captured about 29 percent of the total spent on switching. Of this amount, approximately 90 percent of the equipment involved was manufactured or assembled in the United States. Switch sales by foreign-based firms to the Bell companies have steadily increased from six percent in 1983, to 18 percent in 1984, and reached 29 percent in 1985. Foreign penetration in this market is expected to continue to rise as these vertically integrated foreign suppliers become more established in the U.S. market.

AT&T and Northern Telecom Inc. today supply virtually all Bell companies' switching equipment needs. The present heavy reliance by Bell companies on these firms probably results from the court-ordered "equal access" process. Directed to accomplish significant changes in switching installations over a brief period, Bell companies evidently chose to rely primarily on their traditional suppliers.

Fewer COs will be needed to meet the demands for increased services because of advances in digital technology. The CO switch market is expected to fall annually at a rate of three percent through 1990. CO equipment prices are expected to remain steady over the next three years, after rising about 1.5 percent in 1987.[32] Manufacturers' profit margins may feel squeezed as they attempt to recoup the large R&D expenditures essential to remain competitive in this market.

Other Network Equipment Markets. Multiplex equipment sales jumped about 25 percent in 1987 to $650 million. Statistical multiplexers accounted for $250 million in sales and T-1 multiplexer sales grew to $370 million. Overall multiplexer sales should increase over 15 percent annually through 1990. Statistical multiplexer sales will fall at a rate of five percent while T-1 multiplexers will continue to grow 25 percent annually to $750 million in 1990. Domestic production will follow the sales trend. Sales of carrier line equipment, including digital access cross connects, terminal and line equipment, excluding multiplex equipment, totaled about $2.5 billion in 1987, and will increase eight percent annually through 1990. U.S. product shipments fell about 25 percent in 1986 to $889 million with further decreases expected in the next few years. The packet switch market is also expected to show growth potential increasing 33 percent to about $1.1 billion in revenue by 1990.[33] Packet switch equipment includes packet switch nodes, packet assembler disassemblers (PADs), network controllers, and protocol and network management software. Transmission equipment sales, including microwave transmitters/receivers, fiber optic equipment and cable, and satellites/earth stations, should all prove to be growth markets through 1990.

Overall, the increasing volume of high-capacity fiber optic transmission links should exert a dampening effect on demand for switching and associated traffic management equipment and products. Telecommunications network design always involves trade-offs between the cost of switching and the cost of transmission facilities. Most agree the traditional economics of this trade-off have been radically altered by the advent of fiber optic technology and should further change as the efficiency of fiber continues to improve exponentially over the next few years.

Fiber Optics Market.[34] Kessler Marketing Intelligence (KMI) reported that shipments of cabled fiber in the United States were expected to drop from 1.4 million kilometers (km) in 1986 to 1.15 million kilometers in 1987. U.S. product shipments of fiber optics systems and equipment amounted to $568 million in 1986, eight percent above 1985 shipments. Shipments of fiber optic cable totaled $657 million in 1986. Ninety percent of the cable shipments were for communications applications, and 86 percent of the overall total was single-mode.[35] The U.S. market is described by industry analysts as in somewhat of a glut, even though revenues should increase about 10 percent in 1988.

Over three-quarters of the optical fiber produced in the United States is single-mode. Single mode cable has a core diameter of a few micrometers, thus limiting the light to a single path. This offers an incredible bandwidth capacity of up to 50 GHz/km. This bandwidth capacity and other qualities make single mode cable more suitable for trunking and long haul applications. Multimode graded-index fiber, the fiber used in the long-distance networks, offers a more limited bandwidth capacity ranging from 200 MHz to 1,000 MHz/km. Multimode fiber is cheaper and easier to produce, however, it is increasingly being used in local area networks and in the future may find more applications in the subscriber loop where the bandwidth for single-mode fiber may be considered excessive for potential consumer demands.[36]

Prices of fiber optic cable are on the decline, primarily because of excess supply and a stagnant domestic market. Average prices of $2.80 per fiber meter in 1980 plunged to about 30 cents per fiber meter in 1987.[37] The price decline in cable has been accelerated by the downward trends in installation in the long-haul networks. The price decline is expected to continue into the early 1990s, possibly dipping to as low as 10 cents per fiber meter in 1990.

While some 800 companies in the United States are involved in fiber optic production, a handful of major companies dominate this market. AT&T and Corning together account for 75 percent of the U.S. market in optical fiber. Siecor and AT&T account for a similar share in fiber optic cable. AT&T and Rockwell-Collins are considered industry leaders in transmitters, with the Japanese firms, NEC and Fujitsu, playing a very active role in the U.S. market. Market share is more diverse for sales of fiber optic connectors, but nine firms, including AT&T, AMP, Dorran/3M, OFTI and Amphenol, predominate.

The dramatic growth in the fiber optic market in the United States in the early to mid-1980s resulted almost directly from the high rate of installation by long-haul carriers. With these networks largely in place and/or operational, growth in this market will stall in 1988.

Approximately 64,000 route miles were installed by interexchange carriers by the end of 1987. This compares to almost 48,000 route miles by year-end 1986. According to a recent study by KMI Corporation, the interexchange carriers are expected to have 91,000 route miles installed by year-end 1989.[38] AT&T is projected to have 30,000 route miles installed compared to 19,000 in 1987. US Sprint is expected to have about 23,000 fiber route miles in place compared to 17,000 in 1987, and MCI should have 18,000 route miles versus 6,317 in 1987. The BOCs are projected to install over 44,400 route miles of fiber optic cable in 1987, totaling over 1.1 million fiber-miles in the local loop (fiber miles include all installations such as dark fiber).[39]

Growth is also expected to continue in the establishment of regional fiber networks and in companies extending fiber to businesses from the interexchange carriers. These networks offer "bypass" of the local telephone companies for voice, data, and video traffic. These fiber networks, especially with fiber links installed directly to the business customer, will offer increased bandwidth capacity.

This new bandwidth capacity will enable video markets to develop, particularly teleconferencing and still picture transmission.

Europe-based fiber optic firms including Pirelli and Ericsson have achieved some U.S. commercial success. The latter firm is providing equipment to US Sprint as well as to the large private fiber optic network now under construction in the upper midwest and northeast under the sponsorship of several major electric utilities ("NorLight"). Siecor, half-owned by Siemens AG, has a large share of the U.S. fiber optic market. Most experts believe, however, that AT&T will remain the dominant factor in the long-haul transmission systems market at least through 1990.

Microwave Equipment Market. Analog microwave radio was used as the primary transmission medium for long-haul communications in the past. Technical advances in digital radio and lightwave systems in this decade have eroded the capacity and performance advantages analog radio enjoyed over digital transmission methods. Digital microwave radio is finding applications in the lower-density segment as feeder links to the distribution loop.[40] The growth market is the short-haul segment which is primarily used for point-to-point bypass of the local telephone company. This market is better suited to the higher frequency (18 and 23 GHz) microwave equipment. Long-haul microwave systems, largely analog, are on the decline because of the high rate of fiber installation in the networks. The short-haul equipment market amounted to $77 million in 1987 and should increase about 40 percent annually through 1990. Long-haul microwave equipment sales totaled $85 million in 1987, but sales should fall six percent through 1990.[41] Table 6 shows the U.S. private microwave radio market share in 1986.

TABLE 6
1986 U.S. Private Microwave Radio Market

Company	Percent
Harris	25.0
M/A-COM[42]	23.0
Rockwell	13.0
Motorola	11.0
Digital Microwave	9.0
NEC	8.0
Avantek	7.0
Others	4.0

Source: Salomon Brothers Inc.

Earth Station Market. Satellite networks continue to maintain their cost advantage over fiber-based terrestrial networks for voice, data, and video serving low-density areas and for point-to-multipoint, one-way communications networks. Satellite systems based on micro-earth stations, often called very small aperature terminal (VSAT) earth stations, are expected to be the fastest growing earth station segment. The VSAT market leaped to $76 million in 1987 from $38 million in 1986. Sales are expected to increase 45 percent annually through 1990.[43] The decision of broadcasters to eliminate free access to video signals through scrambling has delayed a more rapid growth in this market segment.

The large earth stations, master hubs for micro-earth station markets, are expected to remain at 1987 levels of about $9 million because most networks are already established. The market for medium-size earth stations are expected to decline through 1990 from sales of $82 million in 1987. The three largest broadcast networks will soon complete construction of their satellite networks and most cable head-ends have multiple antennas directed at the half-dozen satellites carrying most entertainment programming.[44]

Critical Industry Developments

Historical Overview[45]

The U.S. telecommunications industry, together with much of the American economy, is experiencing fundamental commercial and technological changes. Capitalizing on the opportunities presented, while safeguarding the major contributions which this core industry makes to the national welfare, constitutes a major public policy challenge.

Commencing in the mid-1970s, the Federal Communications Commission (FCC) and Federal judiciary radically altered the traditional regulatory landscape. Competitive supply and demand forces were injected into an economic system long characterized by rigid barriers to competitive entry, and sole-source provision of goods and services by persuasively regulated firms to largely captive customers. In 1982, the government announced a settlement of the antitrust litigation launched in 1974 targeting the size, practices, and vertically integrated structure of the former Bell System. Pursuant to that court-approved agreement, the then-dominant U.S.-based telecommunications firm, AT&T, was comprehensively restructured in 1984.

Contemporaneous with these telecommunications industry developments came major and accelerating changes throughout the U.S. economy generally. Beginning in the 1970s, the difficult process of more fully integrating the U.S. and world economies commenced, with adverse effects on a number of basic American industries. While the United States held its domestic markets open, and generally sought to ensure foreign-based firms full and fair competitive opportunities, too many markets overseas remained tightly closed to American entrepreneurs. One obvious result was widening U.S. trade deficits, and the substantial public and political concerns those deficits continue to engender.

At the same time both the telecommunications industry and the U.S. economy were experiencing a complicated and sometimes painful transition, reliance by U.S. business, industry, and government on telecommunications was steadily growing. Increasingly, a pivotal component of our national economic infrastructure, the efficient performance and potential of the telecommunications sector, thus became more critical. The risk that unsound telecommunications policies might adversely affect the industry's performance, then ripple throughout our economy, grew as well.

Competitive History -- Terminal Equipment. Prior to the Second World War II, virtually all U.S. telephone companies required both business and residential subscribers to make use of chiefly carrier-provided, installed, and maintained telephone equipment by imposing sundry tariff restrictions on the use of "foreign attachments." At the time, the principal U.S. telephone companies -- AT&T, GTE, and United -- each had extensive manufacturing affiliates. Restrictions on customer equipment choice, rationalized as necessary to safeguard the technical integrity of the public-switched network, were widely regarded as efforts to ensure "captive markets" for commonly-owned equipment suppliers.[46] The industry argued such limits on subscriber choice, among other things, engendered excess profits that were necessary to cross-subsidize and thus keep local phone rates low.

The first major break in this traditional policy occurred in 1947, when the FCC sanctioned the direct connection of telephone recording and answering devices to the public-switched network.[47] In 1948, the Hush-a-Phone Corporation filed a complaint with the FCC challenging the lawfulness of AT&T tariff prohibitions on the use of a plastic, sound-muffling device that could be clipped onto a telephone mouthpiece in order to facilitate communications in noisy and other work environments. Although the FCC agreed with AT&T that permitting use of this device could give rise to such alleged harms as a "blasting effect" or the instrument handset being "not well-seated on the ear," the Court of Appeals for the District of Columbia Circuit in 1956 overturned the FCC's action and directed removal of the pertinent tariff restrictions on the ground they constituted an "unwarranted interference with the telephone subscriber's right to reasonably use his telephone in ways which are privately beneficial without being publicly detrimental."[48]

More than a decade later, the FCC in its Carterfone ruling ordered broad changes in AT&T's "foreign attachment" tariffs.[49] Thereafter, the FCC in 1976-77 adopted its "registration program," which authorized the interconnection of terminal equipment meeting relatively minimal standards sufficient to safeguard the network from technical harms.[50]

In 1980, the FCC adopted new rules governing carrier provision of terminal equipment as part of its Second Computer Inquiry.[51] The decision in that proceeding deregulated the business of retailing, installing, and maintaining terminal equipment. The Second Computer Inquiry also required the Bell System companies to establish separate subsidiaries to handle regulated and unregulated operations, ostensibly to minimize the potential for anticompetitive cross-subsidization.[52] Contemporaneously, AT&T and its local telephone operating units established a network of retail telephone equipment outlets, "Phone Centers," and AT&T's manufacturing arm, Western Electric, began marketing its terminal equipment through a diversity of retail outlets including Sears Roebuck.

Competitive History -- Network Equipment. Provisions of the 1934 Communications Act apply the antitrust laws (and the procompetitive policies those laws reflect) to trade in communications apparatus. They also establish competition as one of the statute's overall goals. 47 U.S.C. Secs. 313, 314 (1980). In 1934, it was proposed to require competitive bidding by all telephone companies subject to the Communications Act, but the proposal was not adopted. Nevertheless communications common carriers continued to be subject, as they are today, to provisions of section 10 of the Clayton Act (15 U.S.C. Sec. 20 (1980)). The Clayton Act generally requires regulated carriers to use competitive bidding for annual purchases exceeding $50,000 from companies with which they share an officer or director.

The Antitrust Division of the U.S. Department of Justice in January, 1949 filed suit under sections 1 and 2 of the Sherman Act (15 U.S.C. Secs. 1,2 (1980)) alleging that AT&T's ownership of the Western Electric Company had unlawfully restrained competition in the U.S. telephone equipment field. This lawsuit was settled by consent decree in 1956. United States v. Western Elec. Co., 1956 Trade Cas. (CCH) Para. 68,246 (D.N.J. 1956). Under this decree, Western Electric agreed to limit its manufacturing to the support of regulated communications services and the Bell System companies were limited to providing such services. The 1956 consent decree permitted Western Electric to sell goods and services to non-Bell System Telephone companies and it did so until the early Seventies when, evidently concerned about potential antitrust exposure, Western generally discontinued the practice (although it continued to market central office switching systems to independent telephone companies).

The FCC in 1971 commenced an inquiry into the interrelationship between AT&T, the Bell Operating Companies, and Western Electric to determine whether the vertical integration of the Bell System had caused suboptimal levels of innovation, or led to a slackening of competition in the telephone equipment market. At the same time, the world's second largest telephone equipment manufacturer, ITT Corporation, filed a private antitrust suit against the vertically integrated General Telephone System, on the ground GTE's acquisition and control of local telephone companies serving about eight percent of U.S. households had unlawfully restrained competition in the equipment field.[53] ITT also sued AT&T alleging its ownership of Western restrained competition for Bell System business; this latter suit subsequently was settled by AT&T agreeing to purchase several hundred million dollars of ITT products.

In 1977, the FCC ruled that while AT&T's vertical integration had generally benefited ratepayers, AT&T should nonetheless take steps to increase its consideration and purchase of products from nonaffiliated firms.[54] As a result of these pressures, AT&T increased its outside purchases significantly. In 1974, AT&T purchased about $1 billion in telecommunications products from outside suppliers and by 1979, purchases from general trade sources amounted to $1.8 billion. About one-third of all Bell System expenditures for telecommunications products, including Western Electric purchases of components for its own products, went to outside suppliers that year.[55]

As part of its lawsuit against AT&T filed in 1974, the Antitrust Division alleged that the Bell Operating Companies had been required to buy Western Electric products to the exclusion of comparable offerings of superior price and quality available from outside suppliers. The so-called "procurement" part of the AT&T litigation, however, was among those aspects of the complaints essentially dismissed by the trial court in 1981, prior to the announcement of the settlement.[56]

Three lines of commerce currently are foreclosed to the Bell companies by the AT&T consent decree: (1) "interLATA" long-distance or toll communications services; (2) communications equipment manufacturing; and (3) provision of "information" services. Waivers of some of these restrictions have been granted; foreign manufacturing of equipment for certain offshore markets, for example, is now allowed. In general, however, the judicial regulatory regime represented by the AT&T decree continues to rest on basic assumptions that the Bell companies should be "contained," i.e. restricted to providing only local telephone exchange services, and barred from these three ostensibly competitive, partly deregulated communications markets.

The restrictions apparently are based upon the premise that any company having a local exchange franchise is likely to engage in predatory practices in any other market it enters.[57]

Other Regulatory Actions. The Third Computer Inquiry decision maintained the definitional categories of basic and enhanced services, and in place of separate subsidiary rules mandated non-structural competitive safeguards consisting of disciplined cost allocation rules; timely disclosure of technical changes to the network; restricted use of customer-proprietary information on network usage patterns; and "Comparably Efficient Interconnection" (CEI) and Open Network Architecture.

Computer Inquiry III adopts Open Network Architectures as an intrinsic part of basic national regulatory policy. The Open Network Architecture approach is most effectively and efficiently provided by networks comprised of the software-controlled digital central office switches. ONA will offer access to network switching, traffic concentration and interconnection as tariffed basic services elements (BSEs) available on the same terms and conditions for all competitors.

Notification, under the network disclosure provision, must take place when AT&T or a BOC decides to manufacture or procure from an unaffiliated entity any product whose design will affect or rely on the network interface, whether it is software or hardware.

In September, 1987, Judge Greene issued his first decision on the triennial review of the AT&T Consent Decree. At issue was whether marketplace conditions have changed sufficiently to permit relaxation of some constraints on the Bell Operating Companies. The VIII(c) standard in the consent decree requires a showing that no substantial possibility exists that a BOC could use its monopoly to impede competition before the restrictions can be lifted. The major equipment issue was the prohibition on BOC manufacturing. Judge Greene's decision maintained the line-of-business restriction on manufacturing. Judge Greene summarized his decision saying, "No changes have occurred in the last three years that would warrant removal of the restriction on manufacturing."

Judge Greene's decision to maintain the line-of-business restrictions on the Bell operating companies was in direct contrast with the findings of three key government agencies, namely, the Justice Department, the Federal Communications Commission, and the National Telecommunications and Information Administration.

U.S. District Judge Greene filed his decision on AT&T's petition for a clarification of the term "manufacturing" on December 3, 1987. Judge Greene wrote that "there cannot be the slightest doubt that the parties intended by section II(D)(2) to bar the Regional Companies from the entire manufacturing process, including design, development, and fabrication. The decree was aimed at preventing in the future the anticompetitive practices in which the Bell System was assumed to have been engaged in the past." Greene said the companies could handle the design, maintenance and operation of telephone networks, but not the design of "specific products." This decision continues the ban on Bell Operating Company manufacturing of both customer premises and network equipment.

Employment. Total employment in the U.S. telephone and telegraph equipment manufacturing industry fell 7.1 percent in 1987 to a total of 118,600 jobs, following an 11.5 percent drop in 1986. About 68,200 employees were classified as production workers in 1987, a 7.1 percent drop from 1986. Over the 1980-87 period, total employment declined at an annual rate of 3.6 percent. Employment peaked at 153,000 employees in 1980.[58] This drop is expected to continue through 1990. Increased factory automation and more efficient production techniques in manufacturing have reduced the number of people required for production of equipment, especially the newer digital equipment. Foreign penetration of the U.S. equipment market has also displaced a portion of the telecommunications industry workforce.[59]

Compensation rates in communications manufacturing have generally kept pace with productivity gains and outstripped the rate of inflation through 1984. Production worker average hourly earnings remained relatively constant between 1984 and 1986. Average hourly earnings are expected to increase about three percent in 1987.[60] Compensation rates are expected to keep pace with productivity gains through 1990.

Research and Development. The U.S. telephone equipment industry spent approximately $4.4 billion in 1986 on research and development programs covering a wide variety of technologies, including microelectronics, digital switching, transmission, photonics, software, and digital signal processors. Industry expenditures on R&D were expected to increase about 12 percent in 1987, largely because of emphasis on new software development for digital applications.[61][62]

Software is becoming increasingly critical in the development of digital communications, especially in networks being converted for eventual ISDN implementation. In 1987, R&D costs for switching equipment, both software and hardware components, accounted for over one-quarter of total development costs compared to only 10 percent in 1970. Software determines the types of enhanced features available in a network and thus influences a customer's choice of network alternatives. In a digital central office switch, sophisticated software controls the signaling, processing, and routing functions. Testing and network management are also software controlled.

Consent decree restrictions thus affect the efficient functioning and development of the communications services market. Under freely competitive conditions, the locus of certain capabilities within the overall network would be determined by price, efficiency, and performance considerations. This normal evolutionary process is thwarted, however, when institutions dictate that a certain class of new communications service options may only be provided in a given fashion, or only by a particular group of firms. Such determinations, moreover, have the practical effect of sheltering firms which supply advanced terminal equipment from their most likely competition, namely, those which would compete by offering comparable services using central office gear. Consequently, the "information services" restriction skews the market in favor of terminal equipment suppliers, many of which are foreign-based. It also tends to afford them the functional equivalent of a protected U.S. market.

Flatly prohibiting potential new Bell company enterprises also may have had significant effects on research and development (R&D) activities. The consent decree does not explicitly forbid research undertakings. The Bell companies could, in theory, undertake research into virtually any area of the network, assuming regulatory permission, without necessarily violating the decree. This would be the case only in instances where the research was carried out under the banner of "design, maintenance, and operation of the exchange networks," as opposed to "design of specific products." The Bell companies cannot, however, either individually or through their central services organization, Bell Communications Research Corp. (Bellcore), engage in research and then market the results to unaffiliated firms.

The practicalities are, however, that the market for independent research is quite small. Absent the ability to fully exploit research results through manufacturing, few companies evidently spend significant sums on in-house research, and the available information indicates that the Bell companies spend very little on research at this time.

The Bell companies in 1985 spent only about $1,445 per employee on R&D, compared to an average $3,758 for all U.S. industry, according to Business Week tabulations. In 1985, Bell companies had total revenues about three-quarters as great as AT&T and IBM combined. While those two firms in aggregate spent about $5.7 billion on R&D, Bell companies spent only about $800 million directly. (See Table 7.) Bell companies obviously spend considerably more on R&D indirectly, as their purchases help fund R&D activities of other firms. To the extent those purchases are made from foreign-based companies, however, the effect is to fuel R&D activities aimed at commercially besting U.S. firms both here and abroad.[63]

Again, these statistics are subject to qualification. There is no general consensus, for example, regarding what corporate activities should be categorized as "research and development." Spending considered a marketing expense by one firm may be labeled an "R&D" expenditure by another. In the case of firms such as AT&T which are engaged in diverse manufacturing and service activities, the programs and expenditures lumped under "R&D" may be quite broad.[64]

Qualifications aside, it is nevertheless clear that the Bell companies by nearly any measure are only marginal factors in telecommunications research and development today. This is directly attributable to the AT&T consent decree.

Yet many trade experts consider R&D critical to the long-range commercial competitiveness of American industry in most world markets.

Foreign government barriers to U.S. market access abroad persist. Foreign consumers pressing for the ability to purchase U.S. goods and services considered to be technologically superior has proved to lack the necessary impetus to change foreign government restrictive regulatory and trade policies. Especially in light of the lack of market access abroad, increased R&D expenditures are essential to maintain U.S. international competitiveness in the technology-driven communications industry.

Current consent decree restrictions on Bell company activities direct substantial sums toward fueling R&D programs of foreign-based firms. However, government clearly should seek to foster, not undermine, what constitutes a major public policy priority, namely, U.S. technological leadership and excellence in a key "high-tech" sector.

International Markets and Current International Trade Concerns

The overwhelmingly prevalent notion regarding telecommunications trade today is a concern on the part of many policymakers that we are seeing in this rising, "high-tech" sector the unfortunate entrenchment of problems comparable to those which have affected other lines of commerce. To determine whether this general concern is warranted, however, it is first necessary to sketch out some of the telecommunications sector's baseline facts.

The world telecommunications equipment market (apparent consumption) was estimated at $75 billion by NTIA. The United States market accounts for roughly 40 percent of the world market, consuming $29 billion of equipment. The Soviet Union is the second largest market at $9.8 billion or about 13 percent of the world total. Japan accounts for over nine percent, while the European

TABLE 7

R&D Expenditures in Telecommunications and Information Service Industries: 1985

($ Millions)

Industry Group	Annual Sales	After Tax Profit	Annual R&D Expenditures	R&D as % Sales	R&D as % Pre-Tax Profit	R&D Expenditures per Employee
Electronics	$52,100	$1,785	$2,294	4.4%	82.6%	$3,168
Info Processing						
Computers	98,155	8,089	7,554	7.7	53.4	7,562
IBM	50,058	6,555	3,457	6.9	29.8	6,525
Office Equip	6,793	158	412	6.1	207.1	4,468
Peripherals	19,617	499	414	7.0	145.6	6,025
Software Svcs	4,962	418	413	8.3	57.8	6,307
Semiconductors	10,861	146	1,186	10.7	478.6	6,491
Telecommunications						
AT&T	34,910	1,557	2,210	6.3	86.8	6,545
Other Non-RHCs	22,391	-249	595	2.7	neg	N/A
RHCs incl Bellcore (estimates)	82,788	7,485	800	1.3	6.1	1,445
All Industry Composite ($ Billions)	$1,553.4	$80.9	$48.8	3.1%	42.1%	$3,758

Source: Business Week, Shearson Lehman Brothers, Bell Communications Research

Community and Canada account for 27 and 2.5 percent, respectively. These top markets represent 90 percent of total worldwide telecommunications equipment demand. Telecommunications Industry Research forecasts the top ten telecommunications equipment markets in 1990 in Table 8.

TABLE 8
Telecommunications Equipment Market Forecast for 1990

Country	Market ($Million)
United States	27.2
Soviet Union	13.4
Japan	8.5
West Germany	7.7
Italy	6.7
France	6.2
United Kingdom	4.7
China	2.5
Canada	2.3
India	2.3

Telecommunications Industry Research uses a slightly different definition of telecommunications equipment. Although the values appear more conservative, the proportion each country makes up of the total is similar to our estimates.

Arthur D. Little, Inc. estimates the following growth rates by region between 1987 and 1992 in Table 9:

TABLE 9
World Telecommunications Market Growth by Region
1985-1990

Region	Growth Rate
North America	3.0
Europe	4.6
Asia	6.2
Latin America	6.1
Oceania	4.9
Africa	7.7
Total	4.7

There have been very few fluctuations in the prime suppliers of telecommunications equipment by country. The world's largest supplier is Japan which had 27.1 percent of the market in 1985. Sweden overtook the United States as the number two worldwide supplier with 12.7 percent. The United States supplied 11.8 percent followed by West Germany at 11.3 percent and Canada at 9.8 percent.[65]

The world's top ten telecommunications equipment manufacturers are isted in Table 10 according to 1986 sales.

TABLE 10
World's Top Ten Telecommunications
Equipment Manufacturers

Rank	Company	Headquarters	1986 Sales ($Billion)
1	AT&T Technologies	U.S.	10.2
2	Alcatel NC *	Belgium	8.0
3	Siemens **	West Germany	5.4
4	NEC	Japan	4.5
5	Northern telecom	Canada	4.4
6	IBM	U.S.	3.3
7	Motorola	U.S.	3.1
8	Ericsson	Sweden	3.1
9	Fujitsu	Japan	2.1
10	Philips	Netherlands	2.0

* Combined equipment sales of Alcatel and ITT (Telecommunications Division).

** Includes GTE's 1986 equipment sales, except for U.S. switching and CPE.

Source: Arthur D. Little, Inc.

These top ten manufacturers dominate telecommunications markets worldwide. Table 11 lists the top three suppliers in each of the six major world regions.

U.S. Trade in Telecommunications Equipment. Traditionally, the United States enjoyed modest to large trade surpluses in virtually all relevant markets and submarkets. That is no longer true, however, especially in telecommunications. A 1982 trade surplus of about $275 million in telecommunications equipment (SIC 3661 plus 30 percent of SIC 3662), for example, deteriorated to a $2.6 billion trade deficit for 1987. In the broader "electronics-based products" category, results have been more severe. A $4.7 billion U.S. trade surplus in this field in 1982 plunged to a $15.3 billion deficit in 1987, about 9.6 percent of the total U.S. merchandise trade deficit. See Table 12.

TABLE 11
Top Three Telecommunications Equipment Suppliers by Region, as of Year-end 1986

Region	First	Second	Third
Europe	Alcatel NV	Siemens	Ericsson
N. America	AT&T	Northern Telecom	IBM
Asia	NEC	Fujitsu	Alcatel NV
Latin America	Ericsson	NEC	Siemens
Oceania	NEC	Ericsson	Alcatel NV
Africa	Siemens	Alcatel NV	Phillips

Source: Arthur D. Little, Inc.

TABLE 12
U.S. Trade Balance with the World in Electronics-based Products 1982 - 1987 ($ Millions)

Product	1982	1983	1984	1985	1986	1987
Telecommunications	275	-518	-1,110	-1,698	-2,079	-2,549
Computers	6,822	6,207	5,936	5,690	3,542	2,819
Components	-281	-919	-2,968	-2,371	-2,625	-2,581
Consumer Products, Office Products, and Instruments	-2,140	-4,178	-8,520	-12,244	-13,942	-13,028
Total Balance	4,676	592	-6,662	-10,623	-15,1-4	-15,339
Total Merchandise Trade Balance	-42,691	-69,392	-123,312	-148,493	-168,300	-160,000

Source: NTIA

Government, however, underestimated the velocity with which telecommunications trade deficits would subsequently mount. It did not take adequately into account the extent to which a strong dollar would affect U.S. sales. At the same time, the government overestimated the ability of U.S.-based firms (including AT&T) to compete -- and the pace with which foreign barriers to U.S. entry would be removed. Trade deficits in this key sector have grown far more quickly than expected, and too many major markets abroad also remain closed. Consequently, care should be exercised today to develop maximum possible understanding of the current communications environment and thus minimize future unanticipated problems.

Priority of U.S. Market Access. Traditionally, much of the U.S. communications equipment market was sheltered from direct foreign competition. North American and other countries' technical standards differed significantly. Participating in the U.S. market, therefore, entailed equipment alterations. The vertical integration of most U.S. telephone companies -- and the fact there was little demand apart from these companies -- also was generally regarded as a barrier to competitive entry.

While some technical barriers to entry persist, and there remains some vertical integration, the sheer size of the American market makes it worthwhile for foreign-based manufacturers to adapt to North American standards. The computerization of communications equipment makes adaptation simpler today. And, the emergence of corporate users as an increasingly significant demand factor also has had the effect of encouraging entry.

Together, the United States and Canada represent the largest single market where uniform technical standards prevail. (Mexico conforms to the international CCITT standards, but operates as part of the uniform North American numbering plan. Its switching machines have similar translation and signaling requirements.) The European Economic Community, in aggregate, constitutes an economic entity comparable in size to the United States. Efforts by EEC member countries to develop a European standard, however, have not yet succeeded. In most European countries, moreover, telephone companies alone constitute most of the demand, and those companies traditionally have relied on a small group of indigenous equipment suppliers.[38]

Virtually all world-class telecommunications equipment manufacturers today consider securing significant U.S. market share a necessary concomitant to achieving and sustaining global commercial success. Some claim, for example, that a company must have at least seven percent of the world switching equipment market to constitute an effective competitor. This, of course, makes the individual Bell companies especially attractive sales targets as they each individually represent nearly five percent of world demand for certain network products.

All major telecommunications equipment producers worldwide appear to assume that, without a significant U.S. market position, they will be unable to achieve economies of scale, scope, or production comparable or superior to companies now enjoying a significant U.S. base, such as Northern Telecom and AT&T. (See Table 13.) Not only have all major, world-class communications equipment manufacturers targeted the U.S. market, but several have indicated interest in eventually establishing U.S. manufacturing facilities, except in the "low-tech," labor-intensive telephone handset sector. The threshold U.S. annual sales level for such U.S. production, however, appears to be about 200,000 lines of switching equipment. No foreign-based companies except Northern Telecom have yet attained this level of sales.

TABLE 13
Foreign-based U.S. Market Competitors

Japanese	European
Nippon Electric (NEC)	Alcatel NV (CGE)
Fujitsu	Siemens
Hitachi	Ericsson
O.K.I.	Plessey/Stromberg-Carlson
Toshiba	Philips
Iwatsu	Mitel (BT Subsidiary)
Matsushita	
Sumitomo	**Canadian**
Uniden	
Executone Information Systems	Northern Telecom

Source: NTIA

This expressed interest in establishing U.S. manufacturing operations could have positive U.S. employment consequences. But it could have potentially adverse effects as well, including displacing workers in U.S. companies. Establishing domestic manufacturing capabilities might be the first step toward further expansion of the U.S. operations of foreign-based firms. At present, U.S.-based firms capture a significant part of the overall profit associated with the sale, installation, and maintenance of foreign-manufactured telecommunications products. In addition to ordinary distributor and retail markups, "value installed" is often twice the "value shipped." U.S.-based companies that distribute, retail, install, and maintain telecommunications systems produced abroad thus likely earn profits from the overall transaction equal to, if not significantly greater than, those of the equipment's foreign manufacturer.

Several foreign-based communications companies actively seeking to penetrate the U.S. market, in addition to establishing manufacturing and assembly facilities here, are further diversifying and creating U.S. distribution, retailing, installation, and maintenance subsidiaries as well. L.M. Ericsson, for example, has created a U.S. subsidiary headquartered in Richardson, Texas, with separate divisions in Kansas, Connecticut, and New Hampshire. It also has partnerships with Honeywell and an Atlantic Richfield subsidiary that markets cellular mobile radio products. Ericsson's 1986 U.S. sales of telecommunications equipment totaled $300 million.[67] NEC, with "full service" subsidiaries in Europe, has established a U.S. sales and manufacturing subsidiary that has enjoyed tremendous sales growth over the past few years. Sales of NEC communications products in North America expanded from $450 million in 1983 to $4.2 billion in

1987.[64] NEC sold $370 million of telecommunications equipment in the United States in 1986.

West Germany's Siemens organization is another world-class competitor identified as planning to expand U.S. operations into the manufacturing stage of production. Siemens today reportedly has some 24,000 U.S. employees and its U.S. sales in 1987 amounted to $2.6 billion. Siemens' U.S. telecommunications equipment sales totaled $533 million in 1986.

Alcatel NV, now the world's second largest communications equipment maker, has a joint venture with Fairchild Industries to offer and manage "turn-key" corporate communications systems. Alcatel had U.S. telecommunications equipment sales of $810 million in 1986 and its chairman has stated his intention substantially to increase that sales volume. The recent takeover of ITT's telecommunications subsidiary should provide a well-established distribution network from which Alcatel can launch its U.S. drive.

While U.S. firms remain preeminent in many relevant markets, telecommunications trends nevertheless appear reminiscent of U.S. experience in other fields. In the auto industry, for example, Japan-based manufacturers initially relied on U.S. distributors and retailers. They shared the commercial risks of new entry and achieving customer acceptance. Once well-established in the U.S. market, however, foreign-based auto manufacturers often bought their U.S. distributors. In some instances, they sought to purchase the most profitable retail outlets as well. Recently, they have sought to establish U.S. manufacturing and assembly plants, supported by foreign-based suppliers that have also set up U.S. production facilities. The result has been to increase overall foreign profits earned on American market sales.

Foreign-based manufacturers were aided in their U.S. expansion by substantial leverage vis-a-vis American distributors (and retailers as well), many of which were relatively small, single product line operations. Just as such diversification on the part of foreign-based manufacturers into additional stages of production has magnified their profits earned on U.S. sales, the same could occur in communications. Telecommunications partnerships or joint ventures with U.S. companies with economic strength or leverage roughly comparable to foreign firms, however, might lessen any chance of a "squeezing-out" of U.S. distributors and retailers in this sector.

Regulatory Restrictions Crucial.[65] The abundant restrictions placed on established telephone companies both by regulators and the courts under the AT&T consent decree are crucial to the trade deficits the United States has incurred in telecommunications. Federal regulation has adversely affected AT&T's ability to meet growing foreign challenges in telecommunications both at home and abroad. The AT&T consent decree has also limited the ability of Bell companies to engage in several lines of business, as well as in international trade generally, while stimulating U.S. demand for certain communications products supplied by foreign-based firms. At precisely the same time foreign-based challenges to our technological leadership were intensifying, half our domestic telecommunications industry was tied down by judicial regulation and our leading firm, AT&T, was ensnared in a web of state and Federal regulatory constraints. Predictably, our foreign trade predicament quickly worsened.

Pertinent to AT&T particularly are FCC rules instituted in 1980 as part of that agency's "Second Computer Inquiry." Those rules required AT&T and the other companies then comprising the unified Bell System to segregate their competitive and regulated operations in separate, "arm's length" subsidiaries. Commercial and other relationships among and between subsidiaries were meticulously proscribed. FCC rules also deregulated the provision of customer premises terminal devices, and placed certain information disclosure obligations on AT&T and the Bell companies.

Although commendably procompetitive in purpose, and designed to minimize the possibility that telephone companies might gain unfair commercial advantages in competitive markets by leveraging economic power associated with monopoly services, these FCC rules had significant international trade consequences. Deregulating the terminal equipment market, for example, while placing special burdens on the telephone companies' efforts to compete in that field, not only had the effect of opening demand for such equipment to many non-U.S. equipment suppliers, but also handicapping their principal U.S.-based competitors. Requiring disclosure of so-called "network information," moreover, often had the practical effect of requiring the former Bell System systematically to provide commercially valuable information to foreign-based companies.

It was not merely the requirement that there be separate subsidiaries which created problems. Corporations obviously establish subsidiaries routinely for a diversity of legitimate business reasons. The FCC's Second Computer Inquiry rules, moreover, did not necessarily eliminate all potential competitive risks. As critics have noted, their practical effect in many regards was simply to convert difficult cost allocation problems into equally difficult transfer pricing problems. Compliance with FCC rules, however, indisputably placed large cost burdens on AT&T and the Bell companies, burdens not also placed on foreign-based competitors. In 1984, AT&T estimated, for example, that compliance with these FCC rules cost the firm as much as $1.4 billion yearly, estimates which stood largely unchallenged. Even if inflated by a factor of two, these costs constituted more than the combined net income of the competitors the rules ostensibly protected.

In 1985, the FCC proposed and implemented significant changes in the rules applicable to AT&T. The agency also recently adopted new rules that may reduce some of the burdens on the now-divested Bell companies. Full "structural separation" will no longer be required in the case of Bell company equipment and service operations. These changes in FCC rules, however, occurred only after foreign-based firms established firmer U.S. market positions. Government actions thus had the practical effect of according foreign-based telecommunications companies a significant "head start" in their effort to secure U.S. market shares.

While there has been relaxation of many of these regulatory constraints, Bell companies remain uniquely subject to the parallel, judicially administered regulatory regime embodied in the AT&T consent decree. Under that decree, for example, the Bell companies are flatly barred from engaging in equipment manufacturing. They may manufacture abroad for certain offshore markets, but after having secured ad hoc waivers from the judgment court. The Bell companies are also required to use open, nondiscriminatory equipment procurement. Indeed, they are the only part of the domestic U.S. communications sector explicitly subject to such a competitive procurement obligation. While Bell companies are prohibited from competing with AT&T in toll services and equipment manufacturing, moreover, AT&T is permitted to compete in some business service related local exchange markets. Indeed, along with MCI and other long-distance companies, AT&T is endeavoring to do so.

The consent decree's requirement of nondiscriminatory procurement is not new. An analogous requirement was placed on the then unified Bell System in 1976-77 by the FCC. It was part of its "Phase II" proceeding that studied relationships between AT&T and Western Electric. Subsequent to that proceeding, AT&T established the "Bell System Purchased Product Division" which actively sought to develop new suppliers. Bell Canada Enterprise's Northern Telecom subsidiary was one of the first switch suppliers approved as a Bell System supplier. This step significantly contributed to that foreign-based firm's substantial current U.S. market share.

Prior to divestiture, however, a majority of "big ticket" network equipment purchases was still internalized to the Bell System. Western Electric (now AT&T Technologies) was often the lowest cost, most responsive supplier. Today, though AT&T Technologies continues to be AT&T's primary equipment supplier, the divested Bell companies purchase increasing amounts of equipment and other goods and services from foreign-based suppliers.

Vertical integration into design or manufacture of tele-communications equipment is an option foreclosed to Bell companies by the consent decree. They thus necessarily channel their demand -- which represents about 80 percent of total U.S. and, indeed, more than 30 percent of world demand for most "big ticket" telecommunications products -- to outside companies. (See Table 14.) Explicitly enjoined from discriminating in favor of AT&T, moreover, and closely monitored both by Government and AT&T's competitors, Bell companies appear to be actively searching out new suppliers. Not surprisingly, given the preeminent position of the Bell companies as purchasers of telecommunications products in the United States, one apparent effect of the AT&T consent decree has been the increasing U.S. sales enjoyed by most foreign-based equipment suppliers, especially Japan-based firms.

These procurement figures are subject to some qualifications. Prior to divestiture, for example, Western Electric was both a manufacturer and distributor. Pre-divestiture sales figures, therefore, may include products made by other companies, then resold to Bell Operating Companies and AT&T's Long Lines department through Western Electric. Some of the post-divestiture increase in Bell company purchases from "foreign-based" firms reflects large purchases from Northern Telecom Inc. and Siecor, a 50:50 joint venture between Siemens AG and Corning. Both vendors currently manufacture most of the products sold to Bell companies in the United States. These figures, moreover, also may reflect purchases by Bell companies' retail equipment subsidiaries in some cases. Those subsidiaries resell terminal equipment produced by foreign-based firms.

TABLE 14
Bell Company Equipment Procurement
(Percent Purchased from AT&T Technologies)

1982	1983	1984	1985	1986E
92.0	80.0	71.8	64.2	57.6

Source: NTIA Trade Report: *Assessing the Effects of Changing the AT&T Antitrust Consent Decree*, February 1987

All Bell companies, moreover, have indicated publicly that they are seeking additional equipment suppliers. Information supplied to NTIA, furthermore, indicates an increasing amount of Bell company spending for transmission products, and especially fiber optic products, is going to foreign-based and foreign-affiliated firms, as shown below. See Table 15. Foreign investment in communications and associated manufacturing facilities in the United States, moreover, has been growing rapidly, which suggests further changes in Bell company procurement. See Table 16.

TABLE 15
Bell Company Network Products Procurement
Percent purchased from Foreign-based and
Affiliated Firms

	Number of Procurements		
Product	1983	1984	1985
Switching Equipment	6	18	29
Fiber Optics	35	23	40
Transmission Equip.	5	3	23

Source: NTIA Trade Report: *Assessing the Effects of Changing the AT&T Antitrust Consent Decree*, February 1987

It is indisputable that divestiture has had adverse trade effects by channeling telephone company procurement dollars to foreign-based firms. Other provisions of the consent decree, moreover, have had more subtle trade consequences. Bell companies are barred, for example, from providing a broadly-defined category of "information services." Such services include many of the latest communications service options, such as transactional services and least-cost routing of long-distance calls (a service the judgment court ruled also has attributes of prohibited interLATA interexchange service). The Bell Operating Companies may, however, provide voice storage and forwarding services and electronic mail, as well as information transmission services.

TABLE 16
Foreign Company Involvement in U.S.
High Technology Markets 1977 - 1985

Communications Equipment Manufacturing (SIC 336)	1977	1981	1984	1985P
Number of Foreign Affiliates Operating in United States *	14	22	23	27
Assets in U.S. ($ Million)	1,620	2,753	3,178	3,798
Employment in U.S.	NA	36,703	37,901	38,217

* Assets, sales, or net income greater than $10 million in U.S. annually

P = Preliminary

Source: U.S. Department of Commerce, Bureau of Economic Analysis

Many of these new services can be provided technologically at least two ways. The capability can be built into central office equipment; or it can be incorporated into customer premises terminal devices. In the case of "voice storage," for example, service can be provided using telephone company central office switches, as is now done in several countries abroad. Alternatively, it can be provided using a "feature-rich" private branch exchange switch (PBX). Or, in the simplest application, voice storage capability is available using telephone answering machines. Demand for such machines, incidentally, has approximately doubled over the past three years and will amount to some 5.8 million -- more than 15,000 a day -- this year, virtually all of which are manufactured overseas.

By prohibiting the Bell companies from offering various new communications services using central office switching apparatus, customer demand for such new services must be satisfied, if at all, using terminal equipment. In some instances, it may be more efficient to use terminal equipment; in others, central office facilities may be more desirable. The consent decree restrictions, however, override efficiency considerations and indiscriminately channel demand for such "information services" to terminal suppliers. As U.S.-based companies generally have a significantly larger share of the telephone central office switch market than the PBX and other customer premises equipment markets, the net effect is to channel customer demand to products manufactured abroad.

The common argument that allowing Bell companies expanded commercial discretion risks undesirable "foreign entanglements" which could exacerbate our trade deficit also merits close analysis. The trade implications of the initial AT&T divestiture were generally understood when the Administration debated proposals to dismiss that litigation in 1981. Most appreciated that restructuring the Bell System would affect America's international trade posture.

There are, moreover, no restrictions on Bell company procurement of foreign products today. Indeed, existing "open procurement" requirements in the AT&T decree obligate Bell firms to consider foreign purchases. The issue, therefore, is not whether more foreign joint ventures or foreign sales to the Bell companies might occur. Rather, it is whether the incremental change in the number and character of such activities poses appreciably new public policy risks, or offers significant opportunities -- and what, if any, reasonable measures Government might take to maximize upside gains while minimizing downside risks.

Economic Influences. U.S. and world business cycles also contributed to the U.S. communications trade deficits, as did the effects of the AT&T breakup on telephone company purchases. The AT&T settlement was announced January 8, 1982, for example, and there is evidence some of the Bell companies promptly placed a freeze on some planned major system procurement. In late 1981 and early 1982, moreover, the U.S. economy generally was softening, as the United States headed into what proved one of the more severe post-World War II economic downturns.

Business investment, particularly in producer durables, ordinarily declines during recessionary periods. Both business and consumers also tend to defer planned major projects and expenditures. Statistics do not show that U.S. consumption of all telecommunications products declined commensurate with the general economy. Between 1982 and 1985, total consumption of all telephone and telegraph equipment, for example, increased from $13.2 billion to $18.1 billion, representing an 11 percent increase. Much of this growth, however, was in the "low-end" part of the market -- customer premises terminal equipment. Certainly demand for "high-end" products produced for the U.S. market by firms such as AT&T, fell sharply during the 1982-83 timeframe.

The pace with which the U.S. economy recovered from the severe 1982-83 downturn may also partly explain the apparent surge of telecommunications imports experienced in the 1984-1986 period. During periods of rapid economic recovery, imports often increase rapidly. This is usually because domestic producers are unable to expand their output as rapidly as demand grows. Unsatisfied domestic demand thus calls into production unused capacity worldwide and the result is an imports surge.

In telecommunications, deferral of major purchases by Bell companies, as well as some business communications users, presumably resulted in pent-up demand. When general economic conditions improved, and did so rapidly, that may have unleashed demand suddenly and, in the process, stimulated imports. Compounding this problem may have been production problems AT&T encountered in its electronic switch manufacturing operations. The details of AT&T's switch production problems in the months immediately following divestiture are not well known. What is relatively clear, however, is that just as Bell company switch demand was returning to its prior levels, AT&T was not effectively meeting all of those requirements.

The lack of growth in the U.S. export market reflects the overall difficulties that the leading U.S. manufacturer, AT&T, experienced adapting to an international competitive environment. The ongoing integration of the U.S. and world economy has resulted in increasingly intense competition both in this sector and generally. It is no secret that large U.S. corporations have not always proven successful when confronted with aggressive foreign-based -- and sometimes governmentally-subsidized -- competition. Some attribute this to problems with U.S. corporate management generally, with an alleged chronic preoccupation with short-run results, quick profits, and inadequate long-run commercial vision. In the case of AT&T, corporate adaptation problems may also have been compounded by circumstances relatively unique to telecommunications. Most U.S. corporations in the past have been satisfied with the potential the U.S. marketplace offers, representing 40 percent of world telecommunications equipment consumption. Prior to the AT&T divestiture, U.S. manufacturers had little incentive to export.

Persistent foreign tariff and non-tariff trade barriers are one of the main contributing causes for present U.S. telecommunications trade problems.[70] While the United States rapidly opened large parts of its telecommunications market to competition commencing in the early 1970s, most markets overseas remained largely closed. Not until the early 1980s, did foreign barriers to U.S. competitive entry begin to erode. Even today there remain substantial institutional, political, and other trade impediments to U.S. communications firms, notwithstanding procompetitive "privatization" initiatives undertaken in countries including Great Britain and Japan. Denial of foreign market access unquestionably is a major factor contributing to U.S. communications trade problems. Table 17 provides a profile of the regulatory environment and the degree of openness that exists in countries with the largest telecommunications markets.

The United States has the most open telecommunications market followed by Japan, the United Kingdom and Canada. Various other countries have studied the possibility of liberalizing their telecommunications regulatory environments. Among European nations, West Germany has shown some movement towards eliminating restrictive barriers to trade. France, on the other hand, has taken limited actions to promote competition and trade. However, most of the imbedded network equipment will already be purchased or contracts awarded to domestic suppliers by the time these countries implement changes. This will leave a significantly smaller equipment market open to U.S. suppliers, if indeed the markets are ever really open.

TABLE 17

TELECOMMUNICATIONS REGULATORY ENVIRONMENT

Telecommunications Trade Practices Countries by size of Equipment Market in '85		Network Equipment		Terminal Equipment					
		Open International Comp. Bidding	Foreign Company Participation in Spec.	Standards Limited to "No Harm to the Net."	Transparent Standards Setting Proced. incl. Foreign Partic.	Accept Foreign Test Data	Prompt, Non-Restrictive Certification Procedures	Competitive Supply of First Instrument	U.S. Trade Balance in 1987 ($ US-mil.)
United States	($29.9 B)	***[1]	***[1]	****	****	****	****	****	-2,459
Japan	($ 5.0 B)	***	***	****	****	****	****	****	-2,213
Germany	($ 3.9 B)	**	*	*	*	*	**	*	54
France	($ 3.7 B)	**	*	*	*	*	**	****	-31
United Kingdom	($ 2.8 B)	***	**	***	**	*	**	****	170
Italy	($ 2.0 B)	**	**	*	**	*	**	*	200
Canada	($ 2.0 B)	**	**	***	***	***	****	***	-121
Korea	($ 1.3 B)	*	*	*	*	*	*	*	-444
India	($ 1.1 B)	***	**	*	*	*	**	*	35
China	($ 1.1 B)	**	**	N/A	N/A	**	N/A	*	-4
Brazil	($ 1.0 B)	*	*	*	*	*	*	**	280
Sweden	($ 0.9 B)	**	*	***	**	**	***	****	-58
Netherlands	($ 0.6 B)	**	**	**	***	*	*	*	73
Spain	($ 0.5 B)	**	**	**	**	*	**	**	19

Key

* Does not permit the listed practice ** Permits some of the listed practice *** Permits more of the listed practice **** Fully permits or follows the listed practice

[1] While the United States does not fully follow practices it is significantly more open than any other country.

N/A = Not Available.

Source: Office of Telecommunications, International Trade Administration, U.S. Department of Commerce.

TELECOMMUNICATIONS REGULATORY ENVIRONMENT

Telecommunications Trade Practices Countries by size of Equipment Market in '85		Enhanced Services: Can be Provided Without Gov't Approval	Enhanced Services: Cost-Based Pricing of Leased Lines	Enhanced Services: No Restrictions on Use of Leased Lines
U.S.	($29.9 B)	••••	••••	••••
Japan	($ 5.0 B)	••••	••••	•••
Germany	($ 3.9 B)	•	•	•
France	($ 3.7 B)	••	••••	•
U.K.	($ 2.8 B)	•••	••••	•••
Italy	($ 2.0 B)	•	••••	•
Canada	($ 2.0 B)	•••	••	•
Korea	($ 1.3 B)	•	N/A	••
India	($ 1.1 B)	•	•	•
China	($ 1.1 B)	•	•	•
Brazil	($ 1.0 B)	•	N/A	N/A
Sweden	($ 0.9 B)	•••	••	••
Netherl	($ 0.6 B)	•	•••	••
Spain	($ 0.5 B)	•	N/A	•

Key

- • Does not permit the listed practice
- •• Permits some of the listed practice
- ••• Permits more of the listed practice
- •••• Fully permits or follows the listed practice

N/A — Not Available

Source: Office of Telecommunications, International Trade Administration, U.S. Department of Commerce.

Between 1980 and 1985, for example, the U.S. dollar rose some 75 percent in value relative to other world currencies. Consequently, imported telecommunications products may have been particularly attractive to U.S. customers, while abroad, U.S. exports may have been priced out of those few markets which are now open. The decline in the U.S. dollar's value does not appear to have affected the U.S. communications trade deficit yet. It continues to grow. There is ordinarily some lag under such circumstances, however, and positive results of this currency realignment may become more evident during 1988. Foreign suppliers apparently are reducing their previously hugh profit margins rather the increasing prices on their products to reflect the currency fluctuations.

Major Trends and Issues

The total 1986 U.S. domestic market for local loop fiber, interoffice trunk fiber, digital switching, and other digital telecommunications equipment has been credibly estimated by Frost & Sullivan, a leading market research firm, at about $6.9 billion. That figure is forecast by them to increase about 53 percent over the next decade, reaching $10.6 billion in 1996 in constant 1986-dollar terms. U.S. domestic market projected growth rates, however, vary by sector, as shown in the commercially developed figures in Table 18. Interestingly, non-carrier demand is forecast to increase more rapidly than common carrier demand. Corporate expenditures for in-house communications network products, which amounted to about $384 million in 1986, are forecast to more than triple to $1.4 billion in 1996. Purchases by long-distance carriers are likely to fluctuate narrowly in the $750-$850 million annual range. Regulated local telephone companies, however, should continue to constitute the bulk of the market, with their purchases rising from $5.7 billion to $8.4 billion between 1986 and 1996.

Overall, telephone equipment industry shipments are expected to grow steadily during the next five years at an annual rate of five percent (constant dollars). U.S. product shipments of customer premises equipment are forecast to decline by three percent annually over the next five years. Network equipment should increase at about seven percent over the same period.[71]

Government policies long sheltered major parts of the U.S. telecommunications industry from direct competition. On the supply side, competitive suppliers of goods and services were handicapped or barred by Federal and state regulation from competing. On the demand side, customers were not free to exercise choice in most instances. A result may have been to reduce both the appetite and ability of some U.S. telecommunications firms to engage in vigorous and successful competition.

There are obvious exceptions. Leading U.S.-based companies including IBM's Rolm subsidiary, for example, and Motorola were relatively adroit in meeting and typically beating foreign-based competition in their respective telecommunications submarkets both at home and abroad. Other firms such as AT&T, however, did not quickly develop the ability to function in competitive markets because for years the company did not need to, and devoted its resources to satisfying "captive" Bell System requirements.

TABLE 18
U.S. Telecommunications Equipment Market
1985 and 1990E

	1985 ($Million)	1990E ($ Million)	1985-1990E CAGR (%)
Public Network Equipment			
Switching	6,005	5,100	-3.2
Transmission	5,761	9,993	11.6
Other	1,784	1,628	-1.8
Private Network Equipment			
Terminals	1,243	2,018	10.2
Switching	5,662	3,957	-6.9
Attached Processors	55	629	62.8
Data Communications	2,137	6,698	25.7
Bypass Networks	228	556	19.5
TOTAL	22,875	30,579	6.0

E - Estimated
CAGR - Compound Annual Growth Rate
Source: Northern Business Information, Frost & Sullivan

Indications are that AT&T has improved its competitive and marketing talents in the past two years. Although the firm has incurred special charges against earnings and eliminated many U.S. jobs, the investment community has generally viewed these as positive developments likely to produce a more efficient company that will be better able to compete. It is nevertheless true that there have also been some corporate mistakes and commercial failures. During the past three years, moreover, foreign-based firms better able to meet customer demand have prospered and, in some cases, become further entrenched.

The local service providers will be stressing how their companies meet customers' needs for low-cost, enhanced services available through simultaneous voice/data transmission. Digital central offices permit telephone companies to offer new revenue-producing services (speed-calling, conferencing, call-forwarding, call-waiting, and automatic answering) more economically than at present. The Bell Operating Companies will look to foreign and domestic manufacturers for equipment that will best enable them to offer these low-cost, enhanced services.

The Bell Operating Companies and other local exchange carriers will continue to install digital CO switches, but at a greatly reduced rate from the feverish installation in the last few years. The implementation of Open Network Architecture and Comparably Efficient Interconnection will determine the demand for digital switches as well as the demand for software upgrades and add-ons.

Software will be a vital part of the new communications equipment responsible for the control, processing, and monitoring functions of networks. Stress will be on flexibility and cost. Manufacturers will not wait to design equipment to meet future international standards, but will design and modify their equipment so that they can adjust to new standards with little effort or cost. CPE manufacturers will push to include more intelligence or processing in the CPE equipment than available in the common carriers' network. The development of ISDN semiconductors will help to unlock the network's control of all signal processing. This will also lead to an increased dependence on foreign equipment, while stressing the need for increased R&D expenditures for U.S. telecommunications equipment suppliers to remain competitive with foreign producers.

This digital evolution -- together with the demand for local data networks, "office of the future" systems, satellite communications, mobile radio networks, lightwave systems, and sophisticated terminal equipment -- will provide a large and growing market for manufacturers of telecommunications equipment. These technologies will be combined with common carrier service offerings through the various networks to provide a user-controlled package of business services. In addition, programs by other developed countries to convert to integrated digital systems could lead to increased exports by U.S. firms, only if improved market access is achieved.

Some countries are making efforts to liberalize their telecommunications markets. Both the United Kingdom and Japan have privatized their formerly government-controlled networks. Japan has also eliminated tariffs on most telecommunications equipment and streamlined its approval system. Government-controlled postal, telephone and telegraph organizations (PTTs) still dominate most foreign telecommunications markets. Most PTTs, in turn, purchase their network equipment from domestic manufacturers and effectively control the customer premises market by determining standards, testing, and certification procedures.

In other countries, U.S. manufacturers are trying to form joint ventures to break into local markets, thus transferring technology and offering the host countries the benefit of increased employment.

Employment in the U.S. telecommunications equipment industry is expected to decline slightly over the next five years.[72] New technology and workplace changes should result in greater worker productivity, but increased competition for limited product service markets will reduce profitability of companies and lead to acquisitions and mergers among companies specializing in similar product areas.

Notes

1. 1987 Stastistical Review, Annual Market Study of the Telecommunications Equipment Industry, North American Telecommunications Association, 1987, provides a comprehensive, current overview of the business-telephone equipment market in the United States.

2. Customer premises equipment as defined by Frost and Sullivan includes computer terminals in addition to the customary telecommunications terminals.

3. Current Industrial Report, Communications Equipment, Including Telephone, Telegraph, and Other Electronic Equipment, MA36P, 1986, U.S. Department of Commerce, Bureau of the Census.

4. 1987 Stastistical Review, Annual Market Study of the Telecommunications Equipment Industry, North American Telecommunications Association, 1987.

5. 1988 U.S. Industrial Outlook, Telephone and Telegraph Equipment, Chapter 32, U.S. Department of Commerce.

6. Dataquest, Inc. and "AT&T to Build Factory in Thailand," Communications Week, July 4, 1988.

7. Dataquest, Inc.

8. Dataquest, Inc.

9. Executone Information Systems was formed in mid-1988 with the merger of Isoetec and Vodavi making it the third largest supplier of key systems in the U.S. market. Isoetec purchased Executone in 1987.

10. Matsushita supplied over 90 percent of Executone's key systems.

11. Figures are based on a compilation of information from various consultants including Salomon Brothers and Dataquest, Inc.

12. Dataquest Inc.

13. Current Industrial Report, Communications Equipment, Including Telephone, Telegraph, and Other Electronic Equipment, MA36P, 1986, U.S. Department of Commerce, Bureau of the Census.

14. "Centrex Markets and Strategies," Phillips Publishing, Inc.

15. "Special Section: Centrex, The Central Office Phoenix Rises," Network World, July 20, 1987.

16. All forecasts in this report are computed as compound annual growth rates (CAGR).

17. Figures are based on a compilation of information from various consultants including Salomon Brothers and Northern Business Information.

18. Ibid.

19. Figures are based on a compilation of information from various consultants including International Data Corporation, Solomon Brothers, and Venture Development Corporation.

20. Current Industrial Report, Communications Equipment, Including Telephone, Telegraph, and Other Electronic Equipment, MA36P, 1986, U.S. Department of Commerce, Bureau of the Census.

21. "Spending Falls Gently in 1988," Telephony, January 18, 1988.

22. Refer to A Competitive Assessment of the U.S. Digital Central Office Switch Industry, International Trade Administration, U.S. Department of Commerce, September 1986, for a basic description of switching and the central office switch market.

23. NTIA estimates.

24. Current Industrial Report, Communications Equipment, Including Telephone, Telegraph, and Other Electronic Equipment, MA36P, 1986, U.S. Department of Commerce, Bureau of the Census.

25. USTA Telephone Statistics, United States Telecommunications Association, July 1987.

26. 1987 Central Office Equipment Purchase Report, Rural Electrification Administration, 1988.

27. Ibid.

28. "U.S. Central Office Switch Market: A Competitive Assessment of the Digital Central Office Switch Market in the United States," Telecommunications, February 1987.

29. "The Big Switch: AT&T May Absorb GTE's CO Business," Communications Week, July 25, 1988.

30. A Competitive Assessment of the U.S. Digital Central Office Switch Industry, International Trade Administration, U.S. Department of Commerce, September, 1986.

31. A Competitive Assessment of the U.S. Digital Central Office Switch Industry, International Trade Administration, U.S. Department of Commerce, September, 1986.

32. Producer Price Index, Bureau of Labor Statistics, U.S. Department of Labor.

33. Figures are based on a compilation of information from various consultants including International Data Corporation and Salomon Brothers.

34. For an overview of the world market for fiber optic cable refer to A Competitive Assessment of the U.S. Fiber Optic Industry, International Trade Administration, U.S. Department of Commerce, and U.S. Global Competitiveness: Optical Fibers, Technology, and Equipment, U.S. International Trade Commission, January, 1988.

35. International Trade Administration, U.S. Department of Commerce.

36. Datapro Research Corporation.

37. International Trade Administration, U.S. Department of Commerce and Lightguide Digest, AT&T, 1987, Issue No. 2.

38. "US Long-Distance Fiber-Optic Network Nearing 91,000-Mile Mark, Says Study," Communications News, July, 1988.

39. For 1987 fiber deployments see Fiber Deployment Update--End of Year 1987, Industry Analysis Division, Common Carrier Bureau, Federal Communications Commission, January, 1988.

40. "Future Directions in Transmission," Telecommunications, M. Gawden, December, 1987.

41. Figures are based on a compilation of information from various consultants including International Data Corporation and Salomon Brothers.

42. M/A-COM was recently purchased by Hughes Communications

43. Salomon Brothers Inc.

44. Ibid.

45. Refer to NTIA Trade Report: Assessing the Effects of Changing the AT&T Antitrust Consent Decree, NTIA, February, 1987, for a more in depth discussion. Portions of this section were taken from that report.

46. These restrictions are generally applied to public-switched circuits, and not necessarily private line circuits. Similarly, restrictions on the use of carrier-supplied terminal equipment were not necessarily applied in the case of carrier-furnished private networks, although if such networks were interconnected with public-switched facilities, use of an approved network signaling device was typically required.

47. Use of Recording Devices, 11 F.C.C. 1033 (1947).

48. Hush-a-Phone Corp. v. United States, 238 F.2d 266,269 & n. 10 (D.C. Cir. 1956).

49. Carterfone Device, 13 F.C.C. 2d 420, 14 F.C.C. 2d 571 (1968). See also AT&T Foreign Attachment Revisions, 15 F.C.C. 605 (1968), 18 F.C.C. 2d 871 (1969). It should be noted that the Caterfone decision did not initially apply to embedded plant; it gave subscribers the right to use additional terminals of their own choosing, but not necessarily to replace existing equipment. THe FCC in 1975 unequivocally applied Carterfone to embedded plant. Mebane Home Telephone Co., 53 F.C.C. 2d 473, 476 (1975). See generally Fuhr, Competition in the Terminal Equipment Market After Carterfone, 28 Antitr. Bull. 669 (1983).

50. See Registration Program, 56 F.C.C. 2d 593 (1975), 58 F.C.C. 2d 736 (1976). See also North Carolina Util. Comm'n v. FCC, 537 F.2d 787 (4th Cir. 1976). See generally Note, Competition in the Telephone Equipment Industry: Beyond Telerent, 86 Yale L.J. 538 (1977).

51. Second Computer Inquiry, 77 F.C.C. 2d 384, reconsid., 84 F.C.C. 2d 50 (1981), further reconsid., 88 F.C.C. 2d 512 (1981), aff'd sub nom. Computer & Communications Indus. Assoc. v. FCC, 693 F.2d 198 (D.C. Cir. 1982).

52. This FCC separate subsidiary requirement was applied only to Bell System companies. GTE, for example, was exempted. See 84 F.C.C. 2d at 72. The requirement has been continued by the FCC with respect to the divested Bell Operating Companies (see Illinois Bell Teleph. Co. v. FCC, 740 F.2d 465 (7th Cir. 1984)) although other changes have recently been proposed in conjunction with the agency's Third Computer Inquiry (Docket No. 85-229) (FCC Mimeo No. 85-397, 36028 (rel. Aug, 16, 1985)). Certain restrictions were placed on joint service and equipment marketing by GTE subsidiaries under the 1984 consent decree which

enabled GTE to acquire Southern Pacific's Sprint Communications affiliate. See United States v. GTE Corp., 1985-1 Trade Cas. Para. 66, 355 (D.D.C. 1984). Recently, the FCC relaxed certain of these constraints with respect to AT&T's and the Bell Operating Companies' operations. (Docket No. 85-26) (FCC Mimeo No. 85-509, 35963 (rel. Sept. 30, 1985)).

53. ITT Corp. v. GTE, 518 F.2d 913 (9th Cir. 1975). See also Cia. Petrolera Caribe, Inc. v. Arco Caribbean, 754 F.2d 404 (1st Cir. 1985), Montfort v. Cargill, _ F.2d _, 48 ATRR 774 (10th Cir., Apr.23, 1985).

54. AT&T Phase II - Final Decision, 64 F.C.C. 2d 1, 25 (1977).

55. Defendants' Final Statement of Contentions and Proof, United States v. AT&T, filed Jan. 8, 1979 at p. 56, n. 25; 1979 AT&T Ann. Rep. at pp. 12, 15.

56. See United States v. AT&T Co., 524 F. Supp. 1336, 1370-72 (D.D.C. 1981).

57. Brief of the FCC as Amicus Curiae, United States v. Western Elec. Co., filed Apr. 20, 1982, at pp. 32-33.

58. Bureau of Labor Statistics, U.S. Department of Labor.

59. 1988 U.S. Industrial Outlook, Chapter 32: Telephone and Telegraph Equipment.

60. Bureau of Labor Statistics, U.S. Department of Labor.

61. Ibid.

62. 1988 Electronic Market Data Book, Electronics Industry Association, 1988, also provides National Science Foundation statistics on R&D expenditures by electronic industry sector.

63. NTIA Trade Report: Assessing the Effects of Changing the AT&T Antitrust Consent Decree, NTIA, February, 1987.

64. The Computer, Business Equipment, Software & Services, and Telecommunications Industry 1960-1986, CBEMA, 1987, provides R&D data for the telecommunications industry and related sectors.

65. "Different Ways of the World," Telephone Engineer and Management, January 15, 1988, provides an overview of telecommunications equipment trends in the various world markets.

66. / The Telecommunications Industry: Growth and Structural Change, Economic Commission for Europe, 1987, provides an in-depth overview of telecommunications equipment markets in the United States, Europe, and Japan including projections for growth in various equipment categories.

67. U.S. telecommunications equipment sales for Ericsson, NEC, Siemens, and Alcatel NV were supplied by Arthur D. Little, Inc.

68. For an in-depth analysis of 102 international corporations see: The Global Marketplace--102 of the Most Influential Companies Outside America, Milton Moskowitz, Macmillan Publishing Company, 1987.

69. Refer to NTIA Trade Report: Assessing the Effects of Changing the AT&T Antitrust Consent Decree, NTIA, February, 1987, for a more in depth discussion. Portions of this section were taken from that report.

70. The 1987 National Trade Estimate Report on Foreign Trade Barriers, Office of the United States Trade Representative, Department of Agriculture, and the Department of Commerce, 1988, lists the trade barriers for a number of countries including telecommunications equipment trade barriers.

71. 1988 U.S. Industrial Outlook, Telephone and Telegraph Equipment, Chapter 32, U.S. Department of Commerce.

72. 1988 U.S. Industrial Outlook, Telephone and Telegraph Equipment, Chapter 32, U.S. Department of Commerce.

VII

Federal Government Use of Telecommunications

by W. Russell Slye

Telecommunications are vital to the functioning of government, whether it is local, state, or Federal. The workings of government require rapid and timely information to make informed decisions and to direct and control the governmental activities that are removed from the seat of government. The Federal government depends on telecommunications in support of its operations in the discharging of its Constitutionally-mandated responsibilities. In its day-to-day activities, the Federal government uses a vast array of telecommunications services, ranging from conventional wireline telephone service to worldwide satellite-borne data communications. The primary use of telecommunications by the Federal government is in support of providing its services to the public.

As the U.S. population grows and migrates, government operations tend to follow, establishing its presence in new locations throughout the nation. Currently, more than one dollar out of every ten spent on non-military telecommunications products is in support of the Federal civilian workforce, which accounts for only 2.8 percent of the total U.S. workforce. Telecommunications links together the expanding government presence typified by the 20,000 buildings purchased by the government since 1970, and the addition of 73,000 Federal workers. This expansion was necessary to serve the 44 million Americans added to our population since 1970.

Since 1970, government consumption has grown by about 4 to 5 percent annually, compared to about 3 to 4 percent in the overall economy. This growth in government is accompanied by a parallel growth in Federal government services. Many of these services, such as law enforcement and air traffic control, depend on telecommunications for efficient accomplishment. Thus, the growth in government has produced increased telecommunications requirements.

The Federal government is not, generally, a telecommunications provider, either to the public or to government agencies. Except in those cases where commercial services are not available or otherwise suitable, telecommunications supporting government activities are procured from the private sector. Thus, competition in the telecommunications industry impacts government procurement of these services to at least the same degree, if not more, than to private sector users.

Telecommunications services used by the Federal government can be classified into two basic types: (1) those that are based on wireline systems, including those that have access to the public switched networks, and (2) those services based on spectrum-dependent radiocommunication systems.

Delivery of Government Services via Telecommunications

As the national economy shifts from industry-based to service-based, the population has become more aware of the services that are available, and has begun to expect more and better services from the Federal government. Faced with this growing expectation about government services, government agencies have begun innovative uses of telecommunications to deliver government services better and with less cost to the taxpayer. Direct government services include such things as delivering the mail, collecting taxes, providing entitlements, forecasting the weather, and many other activities. Indirect services include national defense, maintenance and management of National Parks, energy management, and law enforcement.

Examples of Government Telecommunications Usage

Direct government services are enhanced by telecommunications techniques that were not available a decade ago. Innovative telecommunications usage has not only increased the capacity and "reach" of the services provided, but in many cases reduced the costs of these services. Examples of this are:

1. The Social Security Administration (SSA) provides direct-deposit electronic funds transfer for 44.5 percent of Old Age, Survivors, and Disability Insurance and 13.6 percent of Supplemental Security Income recipients.[1] Elderly persons no longer have to physically deposit their Social Security checks in the bank. Instances of theft, forgery, and lost checks have been significantly reduced. The SSA, due to advances in computers and data transfer systems, can make its data base available to its employees, allowing customer inquiries that used to take up to six weeks for a response to be answered in a matter of seconds. In October, 1988, the SSA will start an 800-number 24-hour per day inquiry service, using 37 telephone service centers throughout the nation. By the year 2000, SSA telecommunications interconnects with States will allow babies at birth to be assigned a Social Security number.

2. The Internal Revenue Service (IRS) is exploring several alternative methods for filing tax returns. A promising system is electronic filing. Electronic filing will only be available to those expecting a tax refund and filing through a paid preparer. However, for those returns entered this way, the error rate is reduced and 94 percent are expected to be processed within two weeks, as compared to the current five- to-seven week processing time. By 1990, electronic filing should be available to all taxpayers expecting refunds and using preparers, with 45 million returns filed this way by 1994. The IRS handled 66 percent of its 59 million 1987 service requests via its nationwide toll-free telephone assistance system. A new automated telephone system, called the "tele-tax," will provide taxpayer assistance in certain high-volume calling areas. Special services using telephones are also available for the deaf and the elderly.

3. The National Weather Service provides weather information to the public by several methods. Real-time weather forecasts and weather warnings are

carried to 31 million homes via cable television, and 90 percent of the population are within range of one of the 379 NOAA weather radio broadcasting stations. As a public service, NOAA provides current weather information via its Multi-Access Recorded Telephone Announcement System. Annually, more than 500 million telephone calls from the public are received by NOAA regarding the weather.

4. The Department of Health and Human Services (HHS) uses telecommunications in various ways to improve its delivery of health care-related services to the public. The National Institutes of Health has established the "Med-Line," an accessible data base run by the National Library of Medicine. Subscribers to Med-Line can directly query the data base via their personal computer on a wide range of medical subjects. Similarly, the Cancer Institute's "Physician Data Query" (PDQ) allows doctors to check on the latest procedures and treatments for cancer. For those who are concerned about acquired immune deficiency syndrome (AIDS), the Centers for Disease Control has a 24-hour "AIDS Hotline" from which information can be obtained in English and Spanish. Finally, the Health Care Finance Administration, which administers Medicare, is considering a credit card system that would allow Medicare patients to charge prescription medicine directly to the government.

These examples are but a few of the innovative uses of telecommunications employed by the Federal government to improve the delivery of its services.

The Federal Government's Use of Wireline Telecommunications[2]

Current Federal Systems

There are two major organizations that procure and manage Federal government common-user wireline communications. The first is the General Services Administration (GSA). GSA manages the Federal Telecommunications System (FTS), which provides local and long distance telecommunications services to government agencies. It serves not only the 50 States and the District of Columbia, but also Guam, the Virgin Islands, and Puerto Rico.

The second organization is the Defense Communications Agency (DCA) which provides voice and data network services to the Department of Defense. The major voice network of the Defense Communications System (DCS) network is called AUTOVON, for AUTOmatic VOice Network, and which connects all U.S. military bases world wide.

Additionally, most Federal agencies have their own private voice and/or data networks, some of which are quite large.[3]

The Federal Telecommunications System

FTS service began in 1963, about the time that it became apparent that government telecommunications services were inadequate. The President's inability to rapidly communicate with military field commanders and U.S. embassies during the Cuban Missile Crisis dictated the need for an expansive and reliable telecommunications system to serve the ever-increasing needs of the Federal government. Prior to 1980 the FTS was essentially an AT&T system.[4] AT&T provided almost everything; it organized the system, ran it, and when it did not work, repaired it. The GSA role, as compared to today, was minor. AT&T's service was sold to GSA under a bulk tariff called Telpak. Using Telpak, the government saved as much as one dollar per call over the commercial equivalent cost.

In 1977, MCI offered the first competition to AT&T in the form of less expensive service between Washington, D.C. and New York, which GSA bought. In the late 1970s, MCI attempted to buy Telpak tariff service from AT&T with the intention of reselling it. AT&T refused and an appeal to the FCC resulted in a decision that if AT&T offered it to the FTS, then it had to offer it to MCI. As a result, AT&T withdrew Telpak and similar tariffs. The effect of this was that the FTS cost per call rose 27 percent in the first year and 29 percent the next year.

In 1980 GSA analyzed the FTS system and concluded that about 8,000 of the 60,000 AT&T circuits could be procured through a competitive process. Although when competing, AT&T won many of the circuits, large savings were realized from routes won by RCA using satellite technology. In fiscal year 1982 alone, about $3.8 million was saved as a result of cheaper land lines, and in fiscal year 1983, the savings rose to $11.9 million resulting from the satellite circuits being cut over.

Competitive circuit procurements have continued since the original 8,000 circuit competition. GSA established a pilot procurement program which relied on selecting from published tariffs, and encouraging vendors to publish tariffs for attractive offerings. Currently, essentially every circuit is up for competition.

In the 1980s, divestiture became a focus for evaluation, not only for AT&T, but for its competitors and GSA. It also foreshadowed additional complexity in the management of the network, since AT&T no longer influenced the local operating companies and maintenance responsibilities were divided among various providers. Where AT&T at one time was the single point of contact for the FTS, now as many as five vendors are involved in maintenance of a circuit, and up to ten are involved in setting up a new circuit. Installation time for new circuits has increased due to the multiplicity of vendors and contracts involved. GSA spent approximately $500 million in fiscal year 1987 on leased circuits, with an estimated $75 million of this due to the results of divestiture.

Presently, the FTS has 57 high-level switches for inter-city service, and about 300 switches for local service. About 67,000 circuits are maintained for Federal agency use nationwide.

The future of the FTS will be dictated by the tariffs of the time, until the new FTS 2000 system is in place. The budget for FY 88 decreased somewhat, due in part to some Federal agencies, notably defense agencies, dropping off the FTS in favor of private systems. Insofar as possible, single vendors will be selected in the future to provide access area services, and to prevent the problems of fragmented responsibilities.

FTS 2000: A Change in Telecommunications Management Philosophy

In 1981, when GSA examined possible competition in the telecommunications industry, there was insufficient competition for replacement of the whole of FTS. While GSA began a program of FTS improvement, it also developed the strategy for eventual replacement. In 1983, GSA examined the future of the industry through two forecasting firms. They reported that

a. The strategy of the common carrier companies was to develop market share at the expense of short-term profits;

b. All the companies were investing capital in nationwide networks, using digital switches, fiber optics, and software-controlled routing, and

c. Not all of the companies identified in 1983 would survive, but there would be mergers that would result in a minimum of three companies, any of which would be large enough to compete for FTS in 1988

Other factors supporting the replacement of the FTS were that the common carrier industry was moving towards integrated services which would allow for other than just voice service in the FTS, digital technology would bring the cost down, and there was a trend toward overbuilding. Further, technology was rapidly changing, and it seemed advantageous not to lock in current technology, but to take advantage of the opportunity and use GSA's buying power to purchase telecommunications services that "piggy-backed" on future networks.

The upcoming successor to the present FTS is called FTS 2000, with bids from prospective vendors received only this year. This program, which has a potential value of up to $25 billion over ten years, is an example of problems faced by the government in procuring large-scale telecommunications services. Note that the operative word is services, not systems. This change in focus is the major difference in management philosophy between the current FTS and FTS 2000. Where now GSA sizes, monitors, and manages the many parts of the FTS network, leased from a variety of vendors, the FTS 2000 is a contract for services, managed by the winning primary contractors. Whatever switches, trunks, or circuit routes are necessary to provide the required services, the FTS 2000 contractors will arrange for them. The FTS 2000 will be a virtual network, with the inner workings of the system transparent to GSA or any user. As long as the grade of service is satisfactory, equipment and paths used are left to the contractors to optimize the network.

Federal agencies are, in general, required to use the system. Agencies that show that the FTS 2000 is not suitable for their requirements may be exempted on a case-by-case basis. The military services have been requested to determine what requirements can be met by the FTS 2000 before spending tax dollars on duplicative or redundant systems.[5]

The FTS 2000 procurement was to have been a fixed-price contract with a single vendor for a term of ten years. Certain members of Congress, however, have not been favorably inclined toward the GSA plan. The Chairman of the House Government Operations Committee requested that GSA revise the RFP to allow a multi-vendor award, stating that " ... a multi-vendor award with continuing competition throughout the life of the contract will greatly reduce the risks inherent in the project and will ensure that the future telecommunications needs of the government are met economically and efficiently."[6]

The General Accounting Office (GAO) was also critical of the GSA plan.[7] The GAO said that a ten-year, single-vendor award would be undesirable for the government in the long run. The GSA revised the wording in its RFP to clarify that the government is only obligated for an initial four-year period, but also said that revising the RFP to allow for a multi-vendor approach could cause a one- or two-year delay, and could cost the government between $150 and $250 million.

Under continued pressure from Congress, GSA revised its plan and decided to split its procurement between two prime vendors.[8] The contracts would be split 60-40, along lines of Federal Agencies. After a period of discussion among GSA, GAO, and members of Congress, GAO agreed with the current FTS 2000 vendor split.[9] GSA, however, reserves the right to award 100 percent of the contract to a single vendor if it is the government's best interest to do so.

It is anticipated that the successful bidders will manage teams of subcontractors who will provide the various telecommunications services; however, GSA will hold the prime contractors responsible for the total FTS 2000 services performance. GSA has designated a maximum three-year time period, beginning from award of the contracts to completion of the transition period, in which all FTS users will have switched to the FTS 2000.

The issue is perhaps not the choice of a single or multiple-vendor arrangement, but whether the government can efficiently procure telecommunications services on a large scale in a highly competitive environment. Choice of a single point of contact for the operation and maintenance of the FTS 2000 would resemble the monopoly days of AT&T, but the concept of multiple vendors may dilute economies of scale. It is not clear, given the effort, expense and delay caused by the procurement process, what real cost savings will occur.

The role of Congress in future direct procurement of telecommunications services is not clear. If Congress is to be an active player, then the mission of GSA must be modified accordingly. The FTS 2000 procurement foreshadows the problems that the Federal government will have in the increasingly competitive telecommunications environment. The GSA approach seems to be appropriate in this era of fast-changing technology. There is no need for the government to own extensive networks if the commercial systems can accommodate government requirements. Future government procurements can be expected to follow the GSA model.

The Defense Communications System

The Defense Communications Agency (DCA) engineers, manages and operationally directs the Defense Communications System (DCS), which provides the long-haul worldwide communications for the National Command Authorities, the Joint Chiefs of Staff, the Unified and Specified Commanders, the defense agencies, the military departments, and designated subordinate military command elements. The DCS provides critical telecommunications services to a wide range of government customers. The primary purpose of the DCS is to provide communications so that military commanders, from the President on down, will be able to direct their forces. The DCS has a capital investment of over $12 billion, with about $2.66 billion spent annually. Most of the financing of the DCS comes from the military.[10]

The AUTOVON system is the principal long-haul, non-secure, switched voice network of DoD users, and non-DoD users concerned with National Security Emergency Preparedness (NSEP)[11] communications.[12] It provides world-wide, direct-distance dialing, station-to-station service through a system of government-owned and leased automatic switching and transmission facilities. The AUTOVON is a major and integral part of the larger DCS which comprises all DoD non-tactical, long-haul, and point-to-point telecommunications facilities. The mission of the AUTOVON is to provide rapid, world-wide, command and control voice communications service for the National Command Authority (NCA) and other high-priority users. Its secondary mission is to provide an acceptable grade of service for operational, intelligence, logistical, administrative, and diplomatic users.

The AUTOVON evolved from an Army four-switch system begun in 1961, and augmented in 1963 with the North American Air Defense Command's five-switch network. In 1964 the AUTOVON was formally established from these two systems, and in 1966, with the addition of the SAGE/BUIC[13] system, the framework of the AUTOVON became essentially what it was through the 1980s. In 1969-1970, the AUTOVON was extended overseas with the addition of 17 switches servicing U.S. military bases world-wide. The AUTOVON reached its peak in growth in 1971, with 69 switching centers. Network reconfigurations carried out in 1975 through 1979 removed 16 switches from the system.

AUTOVON transmission facilities are a diverse mix of government-owned and leased services consisting of wire, cable, microwave radio, tropospheric scatter radio, and satellite circuits. An inter-area AUTOVON call may well traverse a number of transmission media circuits without the user ever being aware of the multiple paths employed to complete the call.

The data network managed by DCA is the Defense Data Network (DDN), a world wide packet-switched network that links Department of Defense agencies. The DDN is an outgrowth of the first packet-switched data network (ARPANET) developed by the Advanced Research Projects Agency (ARPA)[14] in 1969.[15] More than ten years later, the ARPANET was consolidated into the larger DDN. Currently, the DDN consists of about 260 packet-switching nodes, and 760 host computers with approximately 940 terminals.[16]

The DDN is expected to grow to about 23,700 hosts and terminals by 1990-

91. The DDN budget is likewise expected to increase about $7 million per year through 1989.

The White House Communications Agency, under the direction of the DCA, provides telecommunications, computer systems, and audio/visual support to the President, his staff and family, the Vice President, former Presidents, and the Secret Service.

Other telecommunications networks managed by the DCA include:

a. Automatic Secure Voice Communications network (AUTOSEVOCOM);

b. Defense Switched Network (DSN);

c. Defense Satellite Communications System (DSCS); and

d. Washington Area Wideband System (WAWS).

Public Access to the Government via Telecommunications

Virtually every Federal office space contains a telephone that has access to the public switched network. The public thus has access to Federal employees, or at least to their offices, in all levels of the government via their telephone. The Federal workforce is available to the public as an informal information source on any topic. More formally, several Federal Agencies have established information services that are directly accessible via telephone by the public using personal computers and modems.[17] It is estimated that by 1995 six to eight million businesses and 40-50 million households will have direct electronic access to Congressmen, Senators, and other legislators.[18]

The Federal Government's Use and Management of Radio Communications

This section presents, in brief, the nature and scope of the Federal government's use of radiocommunications, including the dominant factors which dictate such use, and the impact of national policies on government use of the radio frequency spectrum to support radiocommunications.[19] The investment in spectrum-dependent equipment is in excess of $80 billion. This figure does not include the operating budgets required to support the equipment. These radio systems operate on some 240,000 radio frequency assignments.

At the onset it should be recognized that "use of the radio frequency spectrum" covers a range of radiocommunication and electronic facilities far in excess of the "radio" of by-gone years which meant, for the public at least, primarily broadcasting and wireless communications to ships at sea. The Federal government facilities involved include not only radio stations of many categories but a myriad of electronic devices for which uses are characterized by the term "radiocommunications".

In understanding the Federal government's use of radiocommunications, one must appreciate the interplay with non-Federal government use of radio systems, many of which share the same radio frequency spectrum. In addition to the shared use of spectrum, there is a substantial interface between government and non-government radio operations. Non-government ships and aircraft are served by government radio facilities; Federal law enforcement agencies have intercommunication with their state and local government counterparts, Federal electrical power systems interconnect with non-Federal, both domestic and international, Civil Air Patrol stations communicate with the Military -- and so forth.

As discussed earlier, it should be recognized that the government depends heavily on the use of commercial telecommunications facilities in lieu of government-owned and operated landline facilities or radio where such use is feasible.

U.S. government radio facilities, supported by a significant research and development complex, fall in the following categories:

1. Conventional radiocommunication facilities - such as high-frequency overseas telegraph and telephone circuits; satellite communications; radiocommunication services to ships and aircraft; land mobile and microwave communication facilities.

2. Radars (Radiolocation) - such as for the location of aircraft or ships, missile detection and storm cloud observation.

3. Radionavigation facilities - serving ships and aircraft.

4. Telemetry - radio transmission of measured or sensed quantities or conditions of given physical properties such as hydro/meteorological or stress/strain data including the receipt of such information from spacecraft. Radio astronomy observations may be considered as a form of telemetry in the broad sense where the transmitted signals are of natural origin.

5. Various radio frequency spectrum dependent systems - serving the production, control, and protection of natural energy resources such as electrical, solar power, strategic petroleum reserves and oil tar sands.

The requirements for conventional radiocommunication facilities are generally understood; those for the multitude of radio stations and electronic devices involved in those categories (2) through (5) above are, however, generally less known. Nonetheless, the latter represent a major portion of the government's investment in, and use of, the spectrum.

In addition to the radio facilities listed above, the U.S. government also utilizes Carrier Current facilities. These are non-radiating, power line carrier radio frequency systems used for transmission of analog and digital information in the control and protection of electrical power supply systems to insure reliable, adequate, and timely generation and transmission of electrical energy.

Two dominant themes are present in the government's use of radio:

1. The requirement for telecommunications is placed upon the Federal Agencies by virtue of the missions and programs approved by the President consistent with congressional legislative and funding support, and
2. The use of radio rather than other forms of communications is dictated by the inescapable restrictions imposed by time and space.

Radio Spectrum Management

The Communications Act of 1934 established the FCC and provided the framework for telecommunications regulation within the U.S. The Act, succeeded the Radio Act of 1927 and established the division of authority for spectrum management between the Executive and Legislative branches of the government, making them independent, co-equal authorities. Radio stations belonging to and operated by the Federal government do not come under FCC control.[20] The President's authority for assigning frequencies to government stations, and certain other functions, were delegated to the Secretary of Commerce by Executive Order 12046 in 1977. Within the Department of Commerce, NTIA has been delegated these responsibilities, and works closely with the FCC in the regulation and planning of the radio frequency spectrum.

Radio frequency spectrum available for assignment to Federal government stations is shown in the U.S. Table of Frequency Allocations, and amplified by regulations contained in the Manual of Regulations and Procedures for Federal Radio Frequency Management.[21] The U.S. Table is comprised of the government Table of Frequency Allocations, and the Federal Communications Commission (FCC) Table of Frequency Allocations as appears in 47 CFR Part 2. In the early 1940's, spurred by the rapid increase in government requirements for radio systems, the FCC and the President's Interdepartmental Radio Advisory Committee (IRAC) agreed to a national allocation table that contained some frequency bands allocated exclusively for Federal government use, some exclusively for private sector use, and the rest shared between government and non-government users.

As radio services are able to operate in more of the higher frequency bands shared between government and non-government users, planning and regulation of these bands will require closer coordination between the FCC and the NTIA.

Current Use of Radio Systems by the Executive Branch Agencies

o The Military Services

The paramount requirement of military communications-electronics (C-E) is to provide telecommunications, navigation and special purpose electronic systems hat are responsive to the requirements of the National Command Authorities, the Joint Chiefs of Staff, the Commanders of Unified or Specified commands, the Services, and defense agencies. These organizations must accomplish their missions and functions in peacetime, contingency situations, and at all levels of conflict, including general nuclear warfare. Military C-E systems are developed and produced to perform functions that accommodate crisis management, support nuclear strategy, and meet other wartime requirements. These systems are designed to facilitate a rapid transition from peace to war as well as to satisfy peacetime needs. The nature of the systems and the functions to be performed make military tactical and strategic operations highly dependent on the usable radio frequency spectrum.

These requirements demand that sound engineering and administrative practices be applied by the military services toward ensuring efficiency in the management and use of the radio frequency spectrum to support operations. Under normal peacetime conditions, military service needs are satisfied while minimizing the impact on other users through efficiently exercised management. Service needs are met so that the primary uses of the spectrum are in conformity with the international Radio Regulations. Other needs are met on a noninterference basis. The management of the frequency resources required to support a balanced and operationally effective training/contingency program for the military force structure is a monumental task necessitating a constant effort to refine and improve management functioning. It is only through diligent and progressive management and continued technological advancement that the radio communications requirements, incident to national readiness and security, can be adequately met.

Some idea of the military services' dependence on radio frequencies is presented below.

Defense Communications Agency. In addition to landlines (including wire and fiber optic cables) and submarine cables, the DCS includes an extensive worldwide network of troposcatter, microwave, and high frequency (HF) systems, as well as the satellites and earth terminals of the Defense Satellite Communications System (DSCS).

Department of the Army (DA). Radio is the principal means of communications in many Army tactical units. It is used for command and control, exchange of information, administration, and liaison between and within units. Radio is essential for communication over large bodies of water, over territory controlled by enemy forces, and over terrain where construction of wire lines is impossible or impractical.

The Army uses radio systems, which in aggregate, operate across most of the usable spectrum. Tactical units employ mobile and transportable radios, radars, and mobile/transportable earth stations. Army posts, camps and stations use radio in normal administrative and emergency service operations, including instructive broadcasting stations.

In this time frame, training at individual and unit levels has increased radio spectrum requirements for communications, weapons systems and countermeasure tactical systems. This increase stems from introduction of initial models of frequency- hopping radio systems and the need to achieve an early proficiency with this type mode. Fortunately, the majority of these training activities are concentrated geographically at Fort Hood, Texas; Fort Bragg, North Carolina; Fort Bliss, Texas; Fort Sill, Oklahoma; and the Yakima Training Facility near Fort Lewis, Washington. Training at lower population densities occur at some two dozen other bases in CONUS.[22] At Fort Irwin, California, the National Training Center (NTC) is instrumented for unit testing. Army forces are rotated through the NTC as part of the annual testing and evaluation of training. Radio training with tactical and training frequencies is expected to increase.

Army aviation operates in the National Airspace with installed air navigation and radar systems, VHF or UHF equipment for aviation communications and tactical Army FM equipment for communications with tactical forces. New Army attack helicopters now fielded and the increasing airborne attack forces add to the tactical frequency requirements. In addition to its airborne activities, the Army provides personnel and operations for four air traffic control areas.

The Corps of Engineers (Civil Works) maintains 25,500 miles of navigable waterways, locks, and local traffic controls. In this role, maritime radio facilities and procedures are as established nationally. In addition, the Corps of Engineers operates a fleet to support its missions which operate on Army channels. In addition to its maritime activities, the Corp of Engineers operates radio sensing and remote controls for 66,000 dams with most of them producing electric power. This requires approximately 1000 miles of microwave radio relay systems and approximately 60 miles of power line carrier current systems.

Department of the Navy. Navy and Marine Corps forces are organized, equipped, trained, and prepared to maintain a constant state of readiness for immediate and sustained offensive and defensive operations on and under the seas, on land, and in the air. Operations can be conducted unilaterally, jointly with forces of other U.S. Military services, and with allied forces in combined operations.

a. Navy Fleets. The Navy fleets are a vital part of our defense establishment in peace as well as in wartime. Their mission is to perform specific functions in connection with area defense, rapid response strike forces, control and protection of shipping, search and rescue, harbor defense, continental air defense, logistic support, and domestic emergencies. Communications between the fleets and ashore commands, and among the fleet units, require radio systems ranging from extremely low frequency (ELF) through extremely high frequency (EHF), including ship-based earth stations using the Navy Fleet Satellite Communications System (FLTSATCOM). Because of the mobile nature of fleet units, and the requirements imposed by command and control channels, there is no alternative to radio to support fleet telecommunications requirements.

(1) CONUS based fleets and Marine amphibious forces, in a training upkeep or overhaul status, support the forward deployed forces, and are in a ready deployment posture to augment/reinforce deployed elements. In addition, ships and submarines in the inactive status have their own complement of C-E equipment in a preserved state. All this equipment is subject to use upon reactivation of the ships or submarines.

(2) Strategic Deterrent Submarine forces are divided among patrol, upkeep, training and overhaul status.

b. Naval Aviation. Navy and Marine Corps Air Stations support shore based aircraft and fleet deployed aircraft squadrons. Aircraft are equipped with communication transmitters and receivers and equipments such as search radars, IFF[23], navigational aids, electronic countermeasures, and weapon control systems.

c. Naval Telecommunications System. The Naval Telecommunications System (NTS) provides command, control, and communications support to the Navy and Marine Corps operating forces and other military activities. The NTS must be responsive to the requirement for the command, control and support of unilateral naval operations, as well as joint operations undertaken by a Unified Command. The NTS is a worldwide system configured to support naval and joint forces in those ocean areas where the presence of U.S. military and naval power has been determined essential by the Joint Chiefs of Staff or other higher authority. World circumstances and U.S. national interests have required continued commitment of U.S. forces to the Pacific, North Atlantic, Mediterranean and Indian Ocean areas. The Naval Telecommunications System is oriented to the support of forces in these areas. The basic shore elements of the Systems are the Naval Communications Area Master Stations and their supporting naval communications stations. They serve the operating forces and provide a DCS interface.

Department of the Air Force (USAF). The USAF maintains about 10,000 operational aircraft. These aircraft use frequencies in most portions of the radio frequency spectrum for air traffic control communications, command and control communications, navigation and other functions as required to perform the Air Force mission. Avionics equipment in the aircraft must operate not only in the United States but in national and international airspace worldwide.

a. Tactical Air Command (TAC). TAC employs the entire spectrum of electronic radio frequency equipment to achieve its diversified missions. It utilizes a large variety of aeronautical and land mobile general purpose radios and radars, not to mention the numerous special weapons systems and their electronics packages, in support of theater tactical air operations. TAC provides both the aircraft and forward air control equipment to carry out close air support, air reconnaissance, and other related air missions within a combat zone. It functions as the air force component command for the Atlantic Command (USAFLANT/LANTCOM). The command and control systems, coupled with the special weapons electronics packages, place a heavy demand on the frequency spectrum.

The data and communications systems used by TAC to perform both theater air support and national air defense include: satellites, ground and airborne radar systems, Joint Surveillance System (JSS) facilities, drone control and target scoring facilities, tactical UHF/VHF air-ground facilities, HF single sideband stations, electronic warfare and countermeasure equipments, enemy threat simulators, navigational aids, air traffic control facilities, and a multitude of land mobile radio systems. TAC is the Air Force's largest user of the RF spectrum.

b. Strategic Air Command (SAC). SAC maintains a continuous strategic alert force requiring extensive command and control communications support. The SAC Airborne Command Post, Post Attack Command Control System (PACCS), National Emergency Airborne Command Post (NEACP), Air Force Satellite Communications (AFSATCOM) and SAC support of all DOD air refueling tracks throughout the United States require extensive use of the frequency spectrum. Air refueling required interference free operation to prevent any hazard to safety of flight. These same frequencies are also used for bomber/tanker cell inflight coordination. Extensive frequency use is also required to support the Strategic Training Route Complexes (STRC) for combat crew proficiency training. HF frequencies are used to provide long-range radio communications as a survivable medium in a nuclear environment. VHF communications are utilized at all SAC bases for land mobile radio systems. SAC makes limited use of Medium Frequency (MF) radio communications.

c. Air Force Communications Command. The mission of the Air Force Communications Command (AFCC) is to engineer, program for or provide, install, operate, maintain, and manage communications-electronics, meteorological, air traffic control facilities (NAVAIDS), and air traffic control and flight inspection services for the Air Force and for other agencies as directed by the Chief of Staff, USAF.
This mission must be performed during both the static conditions of peacetime and the highly mobile conditions brought about by contingencies and national disasters at indeterminate locations.

National Military Test Ranges. National test ranges, such as the White Sands Missile Range, are major users of the electromagnetic spectrum. Typical equipments/systems are fixed, land mobile, and airborne communication and data links, ground and airborne radars, drone control, beacons, instrument control, and various experimental systems. In addition, extensive electronic countermeasures (ECM) testing is done at some of the ranges.

Military Reserve Components. In addition to the regular Armed Forces, there are reserve units of the Army, Navy, Air Force, and Marine Corps, including the Army National Guard, Air National Guard and the Coast Guard in the United States. The mission of the reserve is to provide trained and qualified individuals to augment the active forces and to provide a combat ready team in time of war or national emergency. The reserve routinely conducts amphibious assault exercises with extensive use of communication-electronic equipments and relies heavily on all parts of the radio frequency spectrum for its communications, command and control capability.

o U.S. Government Civil Agencies

The use of radio by the Federal government civil agencies is characterized by support to a wide variety of missions vital to the operation of the government, and in the rotection of Federal property and law enforcement. A brief description for each ollows:

Department of Agriculture. The Department of Agriculture's use of radio s primarily dedicated to the protection and management of the National forests, vhich comprise about 200 million acres.

The 45,000 radios of the U.S. Forest Service are used in the programs of imber production, forest firefighting, operation of recreation sites, control of vatersheds and water supply areas, control of water and air pollution, wildlife and rassland conservation, and forest research.

Some 7,000 additional pieces of electronic equipment are devoted to the support of other agricultural, hydrologic, and research activities.

Increasing communications needs in the Soil Conservation Service, Federal Extension Service, Animal and Plant Health Inspection Service, Federal Grain Inspection Service and other Agriculture Department agencies have resulted in a rapid increase in numbers of radios in those agencies. As an example, the Soil Conservation Service Meteor Burst Hydrologic system in the West consists of over 500 stations.

The Agriculture investment in radio equipment is in excess of $50 million.

Department of Commerce. The Department of Commerce, in its mission o promote full development of the economic resources of the United States, requires adio to provide essential services to the public and to other agencies of government. Within the Department, the largest user of the radio spectrum is the National Oceanic and Atmospheric Administration (NOAA) which has the mission of nanaging, conserving and monitoring marine resources and to predict atmospheric and marine conditions for the protection of life and property. These services are endered primarily by the following units of NOAA:

a. The National Weather Service (NWS), with personnel located at more than 320 offices throughout the United States and Possessions, is the most pervasive of the environmental science services. Direct use of the service by the public is second only to the U.S. Postal Service. The NWS is charged with observing and reporting the weather, issuing forecasts and warning of weather and flood conditions affecting national safety, welfare and economy. These functions depend on radiocommunication facilities and touch virtually every citizen's life through the public weather service and specialized weather/hydrologic services to aviation, maritime activities, agriculture, space operations, and the like. Its National Meteorological Center is a key center in long range and regional forecasting for the World Meterological Organization of the United Nations. As an example of the public service rendered on a routine basis by the National Weather Service, its National Hurricane Center tracks hurricanes and forecasts their movement and intensity to provide early warnings to populated areas in the storm path. Radiocommunication is a vital element in this operation.

The National Weather Service operates more than 100 weather radars, 134 weather balloon stations, and has in excess of 380 NOAA Weather Radio

Stations which directly provide current weather information to the public. NOAA also operates many other radio stations serving the GOES (platform station) program, the hydrologic telemetry program, the fire-weather program, the hurricane backup communications program, the weather reconnaissance aircraft program, and other miscellaneous radio requirements.

The NOAA Data Buoy Center develops and operates environmental data buoys for weather monitoring, prediction, and various other scientific programs. Data is sent from the buoys and relayed to land via UHF signals through the GOES and TIROS satellites.

b. The National Environmental Satellite, Data, and Information Service (NEDIS), operates remote sensing satellites which make day and night observations of weather (clouds, temperature, and winds), ocean state (sea surface temperature), geological and agricultural features over the entire earth. These and other environmental data are transmitted to ground stations by radio. The data is gathered at the ground and retransmitted via RCA Domsat to a central processing center. The satellites allow meteorologists to monitor cataclysmic weather events such as hurricanes and other severe local storms. They provide sea surface temperature data to the ocean users community and geological and agricultural data to the land users. They relay environmental observations from collection platforms to a central processing center, and transmit processed graphic and image data to meteorological field stations. The satellites also measure the space environment in which they operate and radio these observations to a central site. The meteorological satellite system provides for the collection and radio of data from fixed and mobile environmental observing platforms (ships, aircraft, ocean buoys, and remote surface sites).

There are some 4,100 data collection platforms currently using the data collection radio relay service of the meteorological satellites. These observation platforms are operated by NOAA, other government agencies, and private industry to obtain data on stream flow and water quality, snow depth, and rainfall in remote mountain areas, oceanic measurements from buoys and remote islands, and wind and temperature information from commercial aircraft, for example.

The United States' portion of the meteorological satellite system involves at this time 2 earth stations, 43 satellite data readout stations, and some 2,800 data collection platform radios, an investment of some $500 million including operating spacecraft in orbit, both polar and geostationary.

The polar orbiting weather satellites of the NOAA and the USSR provide a Search and Rescue System that detects a distress signal sent by radio to the satellite, and the satellite provides a location within 2-5 km. There are presently three ground stations in the United States, one in Canada, one in France, and three in the USSR that receive the transmitted data from the Satellite Search and Rescue package.

c. The National Marine Fisheries Service (NMFS), conducts exploratory fishing as well as fish and marine mammal population research programs utilizing HF and VHF radio equipment to provide tracking and migration information as well as communications between major fishery centers and research ships of the NOAA Corps Fleet. NMFS also enforces Federal fish and wildlife conservation laws which relate to the living marine resources with the U.S. 200-mile jurisdictional fishery conservation zone (FCZ). Enforcement agents often coordinate their activities with the U.S. Coast Guard, the U.S. Customs Service, the Drug Enforcement Administration and State fish and wildlife agencies. VHF radio communications is an essential factor during these operations.

d. The National Ocean Service (NOS), radiocommunication facilities are used to support some 23 ships and 18 mobile field parties engaged in oceanographic, marine and geodetic survey, and National Marine Fisheries Service (NMFS) activities. The programs include marine surveys for nautical charts; measurement of tides, currents, winds and ocean states; and research on the Great Lakes, and in international waters. These programs, activities, and related radiocommunications are conducted by NOS to measure the Earth's surface, its coastlines and its undersea features. NOS gathers and stores a myriad of information on the marine environment and its resources for use by scientists and the public. NOS also publishes numerous nautical charts for use by mariners and safety of life at sea. Geodetic survey data includes information for earthquake risk maps. Communications are principally for safety, control of navigation, operations, medical emergencies, and administrative messages between ships conducting joint operations and between ships and shore stations using NOS, NMFS, Navy and U.S. Coast Guard communication circuits. The National Geodetic Survey, an office of NOS, also utilizes radio frequencies in the visible and infrared spectrums for very precise distance measurements. Radio communications between field personnel are handled by voice communications in the VHF frequency band. In addition, the Ocean Services Division (OSD) of the National Ocean Service responds to oil and hazardous chemical spills. Radio communications are used to coordinate clean-up teams and track movement of contamination. Radio communications are employed also in the Outer Continental Shelf Environmental Assessment Program (OCSEAP) in Alaska.

e. NOAA's Office of Aircraft Operations operates 12 aircraft which are engaged in a variety of activities including atmospheric and oceanographic research, aerial photo mapping, flight hazard identification, marine mammal surveys and logistic and support activities for the Outer Continental Shelf Environmental Assessment Program (OCSEAP). The research aircraft operate worldwide and engage in programs which utilize, in addition to the normal VHF, UHF and HF radio communications, X- and C-band radars, passive long and short wave radiation sensors, active radar altimeters and sonde devices and active/passive microwave devices. Two aircraft also utilize satellite communications to transmit data from the aircraft to the National Hurricane Center during the hurricane season. All aircraft utilize the normal VHF, UHF and HF voice channels for operational and administrative communications as well as passive VLF navigation systems.

f. The National Bureau of Standards (NBS) has facilities near Washington, D.C, and in Boulder, Colorado. Radio systems are used for dispatch and control of mail and passenger service vehicles and in support of a number of technical operations at NBS including two-way radio, radio paging, and radio telemetry.

The NBS facility in Boulder is responsible for primary time and frequency standards, and dissemination of these data through radio stations WWV and WWVB in Colorado and WWVH in Hawaii to over one hundred thousand listeners throughout the world. High precision time signals are sent and received from domestic communication satellites at 14 and 12 GHz. NBS also conducts extensive experimentation using the radio spectrum in such areas as testing instruments for earthquake calibration measurements. Specific areas of radio usage include communication, data telemetry, and satellite transfer of information.

g. The Institute for Telecommunication Sciences (ITS), within the National Telecommunications and Information Administration, conducts research and engineering support in communications devices, radio propagation, and advanced telecommunication technology. Particular emphasis is on the use of millimeter waves as a means of extending usable spectrum. Techniques include computer simulation, propagation measurements, and propagation modeling.

The Department of Commerce investment in radio equipment is in excess of $610 million.

Department of Energy. The Department of Energy (DOE) was established under Public Law 95-91 of 1977, by reorganizing energy functions within the Federal government to establish and implement policies regarding international and national energy issues, to provide for the administration of the functions related to nuclear weapons and national security, and to provide storage and retrieval facilities for imported crude oil. The DOE utilizes approximately 6000 radio frequency assignments from the low frequency (8 kHz) range through the laser frequency (585 THz) range to support the Department's functions of electrical power transmission and marketing, nuclear and national security programs, and petroleum reserves. In addition, the DOE is responsible for the operation of more than 1300 power line carrier circuits.

a. Electrical Energy. The DOE, through its five Power Marketing Administrations, markets electrical energy generated at 123 Federal hydroelectric projects from Alaska to the east coast. The energy is carried over more that 31,500 miles of high voltage transmission lines to serve 947 customers (municipalities, rural investor-owned utilities, industries, and other public bodies). To protect, control, and maintain these extensive networks, DOE uses more than 1300 power line carrier circuits from 8 through 496 kHz and 2,950 assignments in the HF, VHF, UHF, and SHF bands for fixed, land mobile, aeronautical mobile, mobile, and meteorological satellite services.

The transportation of electrical energy from the generating plants to the load centers and the interconnection of bulk electrical power supply systems for reliability and adequacy have resulted in the development of extremely complex national networks aimed at the optimum economic configuration. The systems have, as integral and critical parts, extensive telecommunications for voice and data. These telecommunication networks are the nerve systems between control centers and many hundreds of generating stations, switching stations and substations, which are required to operate harmoniously as an interrelated and interconnected whole. These telecommunication facilities must be of the highest level of reliability, economically and technically feasible, and must be instantly available for the successful operation of the Nation's electrical power systems.

b. Nuclear and National Security. The DOE uses radio communications for voice, data, and video in the MF, HF, VHF, UHF, and SHF bands to support nuclear and national security efforts.

Five national laboratories, eight production plants, and the Nevada Test Site play significant roles in design, development, engineering, production, surveillance and testing of nuclear weapons. Supporting these facilities are radio systems in the radionavigation, fixed, mobile, land mobile, aeronautical mobile, maritime mobile, radiolocation, and experimental services.

c. Petroleum Reserves. The strategic petroleum reserves program provides storage and retrieval facilities for imported crude oil. It is controlled from New Orleans and has terminal and storage facilities located at six sites along the Gulf Coast at Louisiana and Texas. The complex has five VHF-FM radio networks that cover the local area around each of the sites. Each site also has a radio paging system, and there is a microwave link for pipeline control.

d. Investment. In total, DOE's investment in radio communications systems and utility telecommunications systems used mostly in supporting the Electrical Energy Production and Marketing Program, the Defense Program, and the Petroleum Reserves Program is about $750 million.

Federal Emergency Management Agency. The Federal Emergency Management Agency (FEMA) was established in the executive branch as an independent agency in 1979. FEMA was created to provide a single point of accountability for all Federal emergency preparedness, mitigation and response activities. The Agency is chartered to enhance multiple use of emergency preparedness and response resources at the Federal, State, and local levels of government in preparing for and responding to the full range of emergencies -- natural, man-made, and nuclear -- and to integrate into a comprehensive framework activities concerned with hazard mitigation, preparedness planning, relief operations, and recovery assistance.

To ensure the overall integration of the programs administered by FEMA, a systems approach strategy has been developed known as the Integrated Emergency Management Systems, or IEMS. IEMS builds on a foundation of preparedness and response elements (such as direction, control, and warning systems) which are common to the full range of emergencies -- from small, isolated events to the ultimate emergency of a war. These elements are being developed and improved across all levels of government.

The FEMA organization responsible for coordinating internal response to national emergencies is National Preparedness. This directorate develops, coordinates, and executes plans and programs providing for continuity and effective operation of the Federal government during national emergencies; provides facilities and resources for management and coordination of emergency information; and provides centralized coordination and control and day-to-day management of the National Emergency Management System (NEMS).

NEMS consists of the total telecommunications and data processing resources necessary for FEMA to accomplish its assigned peacetime and wartime functional responsibilities and meet all established operational requirements under the IEMS umbrella. Current capabilities of NEMS include the National Warning System; the FEMA National Teletype System; the FEMA National Voice System; the FEMA National Radio System; the Direction, Control, and Warning System; and the capability to activate the Emergency Broadcast System at the direction of the President.

FEMA has investments in radio equipment in excess of $200 million.

General Services Administration. The General Services Administration (GSA) has the responsibility to protect Federal property under its charge and control and to ensure a safe, secure environment for conducting government activities. Property protected by GSA includes 21,000 space assignments, housing 887,000 Federal employees in 6,800 government-owned and leased buildings.

The primary use of GSA's radio systems are for law enforcement and buildings management operation. The radio frequency system includes portables and mobiles, base stations, paging, intrusion detection, access control and closed circuit television.

The total GSA investment in radio frequency equipment is in excess of $40 million.

Department of Health and Human Services. The principal user of radio spectrum in the Department of Health and Human Services (DHHS) is the Public Health Service (PHS). The Indian Health Service (IHS), a component of the Health Resources and Services Administration, a PHS operating agency, is responsible for about 80 percent of the approximately 1400 frequency assignments utilized by DHHS. The IHS supports the delivery of health care to Native Americans by using radio to communicate with emergency medical vehicles, remote health stations and mobile health units. Radio is also used extensively for paging systems to communicate with key medical personnel. In Alaska, the IHS uses both HF radio and common carrier satellite communications to provide "Doctors call" assistance to village health aides at isolated locations. IHS radio base stations at 50 hospitals also communicate with

60 tribal government ambulance services for dispatch and control to respond to serious medical emergencies at remote Indian locations. The IHS participates in State emergency radio networks to coordinate the rendition or delivery of medical care using medical radio communications frequencies. The Bureau of Devices and Radiological Health, Food and Drug Administrations and the Lister Hill National Center for Biomedical Communications use frequencies for experimental purposes. The PHS also uses radio frequencies for bio-medical telemetry to conduct medical research and for monitoring the treatment of patients. Radio frequencies are used by the Office of the Secretary and DHHS operation divisions for communications to control various security and administrative operations.

Department of the Interior. The Department of the Interior is custodian of 750 million acres of land and is charged with the conservation and development of the Nation's natural resources. It has a wide variety of radio operations throughout the spectrum distributed among nine operating bureaus with diverse missions serving the public and protecting the country's natural resources. The major activities using radio are:

a. Point-to-point fixed base station and mobile radios for land management and protection and development of natural resources as required by the Bureau of Land Management, which manages one-fifth of the Nation's gross land area -- some 341 million acres, the National Park Service, which manages some 335 areas totaling about 79 million acres, hosting more than 350 million visitors annually; the Bureau of Indian Affairs, responsible for the welfare of some 500,000 Indians and Alaskan natives on 50 million acres; the U.S. Fish and Wildlife Service, which manages over 400 National Wildlife Refuge areas, covering 90 million acres; the Geological Survey for earthquake studies, geologic and topographic mapping operations, and for the collection of hydrologic data by both terrestrial and satellite radio communication facilities; and the monitoring of off-shore oil fields by the Minerals Management Service. In all these areas of activity the primary use of radio is for the management, production and development of the Nation's natural resources, forest and range fire suppression and protection of property and public safety.

b. Water Management, control and distribution by the Bureau of Reclamation is a major factor in the growth and economy of the West. Telemetry, land mobile and point-to-point radios are essential to the operation of the Bureaus 320 water storage dams and reservoirs, 344 diversion dams, 51,000 miles of carriage and distribution channels and canals, and 145 very large pumping stations. These provide irrigation for more than 12 million acres of agricultural land, providing 30 million acre feet of water for the use and consumption of over 20 million people and water for the operation of 51 hydro-electric generating plants.

c. The government of American Samoa and the government of the Trust Territory of the Pacific Islands which provide, in their respective areas, public correspondence (including overseas telephone and telegraph); radio communication services to ships and aircraft; local broadcast, AM, FM, and

TV; amateur radio, and numerous utility services incident to the responsibilities of civil government.

The total investment in radio equipment is in excess of $150 million which includes approximately 75,000 portable/mobile equipment and over 3,750 land/fixed stations.

Department of Justice. The Department of Justice is the largest law firm in the nation, and indirectly serves as counsel for citizens of the United States. It represents them in enforcing the law in the public interest. Through its thousands of lawyers, investigators, and agents, the Department plays a key role in protection against criminals and subversion, in control of the country's borders, in ensuring healthy competition of business in our free enterprise system, in safeguarding the consumer, and in enforcing drug, immigration and naturalization laws.

Major users of radio systems in DOJ are: The Federal Bureau of Investigation (FBI); The Immigration and Naturalization Service (I&NS); The Drug Enforcement Administration (DEA); The Bureau of Prisons (BOP); The United States Marshals Service (USMS); and The Community Relations Service (CRS)

Radio systems are used by the Department of Justice to serve the national security; to safeguard life and property; and to support crime prevention and law enforcement. The radio systems used by the Department of Justice to effect these responsibilities consist primarily of land mobile radio facilities. Tactical communications among investigative, protective and enforcement personnel in the field as well as liaison communications with cooperating law enforcement organizations are essential operational tools. Mission success as well as safety of life and property is frequently dependent upon the availability of radio communications systems.

The radio systems of the Department of Justice represent an investment of about $131 million and involve annual expenditures of approximately $64 million. These figures represent a significant increase over the past year, due mainly to use of more sophisticated (i.e., Digital Voice Privacy) equipment by the FBI. It is expected that the trend will continue to more sophisticated systems by the bureaus requiring an increase in frequency usage.

National Aeronautics and Space Administration. The National Aeronautics and Space Administration (NASA) is charged with the conduct of research and development in the areas of space science, astronautics and aeronautics. NASA is responsible for near and deep space exploration using both manned and unmanned spaceflight vehicles. Also, NASA has an ongoing terrestrial and space applications program. The Search and Rescue (SARSAT), the Mobile Satellite (MSAT) and the Advanced Communications Technology Satellite (ACTS) programs are illustrative.

In short, all of NASA's R&D and application programs are more or less dependent on radio communications systems. The total NASA investment in low Earth orbit and deep space tracking facilities and other support functions using various radio telecommunications devices and systems is well over $2.5 billion.

From an operational point of view, NASA is currently providing launch and racking support for approximately 45 spaceflight vehicles. (This includes NASA, other Federal agencies, commercial and foreign government spacecraft or satellites.)

National Science Foundation. The National Science Foundation (NSF) has the responsibility of promoting scientific knowledge, and to this end it initiates and supports fundamental and applied research in all scientific disciplines. The NSF sponsors major national and international science programs both of a special and a continuing nature. It sponsors small, as well as, large research projects throughout the Nation's academic and scientific communities, and it funds large research facilities at national centers which would be beyond the financial scope of individual institutions. Among the national centers are: Cerro Tololo Inter-American Observatory (CTIO), Kitt Peak National Observatory (KPNO), National Astronomy and Ionosphere Center (NAIC), National Center for Atmospheric Research (NCAR), National Radio Astronomy Observatory (NRAO), and Sacramento Peak Observatory (SPO). The facilities at these centers are for use by any qualified scientist and researcher based at universities throughout the United States, which comprise the majority of the user community.

There are numerous areas in which the radio spectrum is used for scientific research. The spectrum plays a vital support role for experiments, with telemetry from remote sensing platforms such as balloons, meteorological sensors, ocean buoys, or transmitters attached to animals. Telecommunication links must be provided to coordinate experiments and to maintain contact with remote sites.

Radio astronomy is a major activity of facilities and research funds by the NSF. The current investment in radio astronomy facilities in the United States exceeds $250 million. The NSF is deeply concerned with maintaining a suitable electromagnetic environment so that radio astronomy research may continue unabated.

Department of Transportation. The Department of Transportation was established for the purpose of developing national transportation programs conducive to the provision of safe, fast, efficient, and convenient transportation in land, sea and in the air. The achievement of these objectives, particularly in the air and marine environments, is totally dependent upon the continuing availability of rapid and reliable communications. Since radio is the only practical means of communicating with mobile units, achievement is equally dependent upon spectrum space. Radio spectrum utilization by the several operating administrations of the Department serves numerous and diverse operational and technical functions. Nevertheless, these operations have a common purpose -- the enhancement of the safety factor, or one or more of the other important aspects of transportation for the general public.

Within the Department:

a) The mission of the Federal Aviation Administration is to provide for the safe and expedient movement of aircraft, both civil and military. In so doing, it uses radio frequencies for communications, radionavigation and radar. Radio frequencies are assigned for use at approximately 2,680 air/ground communication sites, 844 instrument landing system facilities, 950 en route and terminal VHF omnidirectional ranges and 334 radar stations.

These facilities serve some 225,313 registered civil aircraft flying 43.5 million hours per year. The FAA has approximately $1.7 billion of electronics equipment, operating throughout the spectrum. Expenditures for facilities and equipment from 1983 through 1992 will exceed $11 billion.

With annual research and development programs in excess of $100 million, FAA directs over half into surveillance, communications, navigation, and support of efforts involving the use of radio frequency spectrum. These include research and development efforts in air traffic control, navigation, radar, aircraft separation assurance, communications, satellite, support and weather programs.

b) U.S. Coast Guard missions include (1) Maritime and recreational boating safety, (2) Search and Rescue services, (3) Maritime law enforcement, (4) Marine environmental protection, (5) Port safety and security, (6) Aids to Navigation, (7) Marine science activities, (8) Enforcement of offshore fishery laws, (9) Suppression of smuggling, and illicit drug trafficking, (10) Ice operations, both domestic and in the polar regions, (11) Maintaining a state of military readiness, and (12) Operating vessel traffic systems. The missions are carried out in behalf of the general maritime community and the use of radio systems is essential in carrying out these tasks.

Coast Guard operations are supported by (1) a network of about 563 ship/shore radio stations for safety and distress communications with the general maritime community and for command and control of its own fleet of about 255 vessels and 2,100 smaller, radio-equipped rescue craft, (2) a network of 26 aeronautical radio stations for operational control of its fleet of about 200 aircraft, (3) a national network of about 200 radiobeacon stations used by small recreational and commercial vessels operating in coastal waters, and (4) an international network of 40 LORAN[24] radionavigation stations and two Omega radionavigation stations used primarily by larger vessels at sea and by air and surface units of the armed forces.

The total Coast Guard investment in communications-electronics installations is about $1 billion. Additionally, the investment in special equipment for use with Coast Guard operated radionavigation systems is about $600 million.

Department of the Treasury. The Department of Treasury is responsible for enforcement of Federal laws pertaining to protection of the President and other designees, as well as those dealing with counterfeiters, forgers, smugglers, moonshiners, gun law violators, tax evaders, etc.

Telecommunications devices such as portables, mobiles, base stations, lasers, infrared beams, microwave sensors, ground intrusion sensors, and radars play a vital ole in detection and apprehension of criminals, and the safety and welfare of law nforcement officers.

Radio communications are vital for the administration and management of ne U.S. Secret Service, U.S. Customs Service, Internal Revenue Service, and the ureau of Alcohol, Tobacco and Firearms, as well as the non-law enforcement ureaus such as the Bureau of Engraving and Printing, the Bureau of the Mint, the omptroller of the Currency, and the Federal Law Enforcement Training Center.

To support its missions, the Department of the Treasury has an investment f approximately $100 million in spectrum-dependent equipment.

Tennessee Valley Authority. The Tennessee Valley Authority (TVA) is a ultipurpose regional development agency involved in activities such as flood ontrol, agriculture and environmental research, forestry, recreation, diversified ndustry and the largest electrical utility in the United States, with some 31,109 egawatts of power generating capacity in service and another 8,000 megawatts of apacity under construction to meet power demands in the 1980s; 17,000 miles of ransmission line are used to serve 25 million people throughout the 80,000 square ile area.

The TVA uses extensive powerline carrier, microwave, land mobile and oint-to-point radio systems to aid in carrying out its responsibilities for the anagement and operation of a two billion dollar per year multipurpose activity hich is essential to the socioeconomic well being of the South.

The total investment in radio systems is approximately $25 million and in ower line carrier systems approximately $20 million.

United States Information Agency. The United States Information Agency USIA) has the mission to promote understanding abroad for the United States, its olicies, its people and its culture. As the official voice of the U.S. government, SIA plays a significant role in the achievement of long-range foreign policy bjectives as it informs and explains, encouraging the maximum flow of ideas and nformation between the people of the United States and the people of other ountries. The Agency provides a consistently reliable, objective, and authoritative ource of news to give a balanced view of American society and a background against hich a listener can better understand what is happening in this country and the orld.

Radio is the only means of communicating directly with peoples of other ations. USIA's global radio network, the Voice of America (VOA), consists of 107 hortwave and medium wave transmitters located in the United States and ten oreign countries with a total transmitting power of over 22 million watts. A total of 60 hours of direct broadcast programming in 42 languages are transmitted overseas ach week reaching an audience estimated to exceed 100 million listeners. All roadcasts originate from studios in Washington, D.C., and are transmitted imultaneously by microwave or leased satellite circuits to domestic relay stations perating a total of 75 transmitters. These broadcasts are then simultaneously re-roadcast on shortwave and medium wave frequencies to designated target areas.

In addition to the direct broadcast, VOA operates a radio teletype network five days a week sending regional transmissions of policy statements and interpretive material to over 100 USIA posts abroad.

The investment in transmitter facilities exceeds $180 million.

U.S. Postal Service. The US Postal Service (USPS) uses radio communications for Vehicle Control, Plant Maintenance and Mail Processing. The Postal Service also makes extensive use of mobile radios for law enforcement purposes (See report on the Postal Service).

Veterans Administration. The United States has the most comprehensive system of assistance and care for veterans of any nation in the world. Executive Order 5398, signed by President Herbert Hoover on July 21, 1930, established the Veterans Administration (VA). It brought together under a single agency responsibility for the various veterans programs passed by Congress over the years. The Administrator of Veterans Affairs is the largest of all independent Federal agencies; only the Department of Defense and the Postal Service have more employees. Recently, the VA has been proposed to be elevated to a Cabinet-level position.[25]

To provide expeditious health care the VA makes extensive use of radio paging, two-way radio, wireless microphones, cardiac telemetry, Emergency Medical Service radio nets, CB radio, vehicular radar, microwave transmission systems, and High Frequency (HF) emergency contingency radio nets.

The VA is in the final stage of establishing a nationwide HF Emergency Radio Network to permit communications in the event that the national switched telephone resources are disrupted. This network will link the VA's three Supply Depots, three Relocation "C" Sites, and the VA Central Office. These stations will be able to communicate with one another by two-way radio and radio-teletype facsimile service. Plans are being developed to expand the network to include the nine VA coordinating hospitals and 61 VA hospitals designated as primary receiving hospitals, in accordance with the VA/DOD Hospital Contingency Plan.

Procurement of Radiocommunications Services

The Federal government places heavy reliance on the private sector in providing telecommunications service for its own use. This means that all functions normally associated with providing the service shall be performed by the private sector. These functions include design, engineering, system management and operation, maintenance, and logistical support.

In order to emphasize the government's proper role as a user, any proposal designed to provide needed telecommunication service, which requires the government to perform any of the "provider" functions, such as those listed above, are adopted only if commercial service is: a) not available to the user during the time needed; b) not adequate from either a technical or operational standpoint; or c) significantly more costly.

A non-commercial service approach is acceptable if such an approach will result in significant savings over an otherwise acceptable commercial service offering. To be considered significant, the savings must exceed ten percent of the cost of the commercial service. The cost estimate of the non commercial approach must include, at a minimum, all of the factors in OMB Circular A-76. If the proposed approach involves heavy investment, rapid obsolescence, or uncertain requirements, the minimum savings threshold is increased to reflect these factors.

Within the jurisdiction of the United States government, Federal government use of the radio frequency spectrum for telecommunications is authorized only by the Assistant Secretary for Communications and Information. In view of the limitations of the usable radio frequency spectrum, and to ensure the best possible return from that use, the government in time of peace requires all Federal government users to a) justify any except emergency requests for radio frequencies prior to the assignment and use of these frequencies; b) confirm periodically the justification of continued use, c) employ up-to-date spectrum conserving techniques as a matter of normal procedure, and d) assure the ability to discontinue the functioning of any emitting radio system, including satellites, when required in the interest of communications efficiency and effectiveness.[illegible] The government establishes separate communications satellite systems only when they are required to meet unique governmental needs, or are otherwise required in the national interest.

Federal Government National Security Emergency Preparedness (NSEP) Telecommunications

The National Communications System. A National Communications System (NCS) was first mandated in 1963 by President John F. Kennedy as a direct result of events during the Cuban Missile Crisis. President Kennedy and other top officials were frustrated by their inability to communicate quickly and reliably with U.S. military and government agencies, with diplomatic corps overseas, and with heads of foreign governments. The NCS was originally envisioned as a single integrated telecommunications system that would be designed and implemented by the linking together of selected government telecommunications systems to meet the most critical NSEP telecommunications needs.

The changes occurring in the dynamic and rapidly advancing telecommunications industry made it increasingly difficult for the government to ensure the provision of its NSEP telecommunications services in times of crisis or emergency. Recognizing the need to coordinate with the commercial telecommunications industry, which provides over 90 percent of the government's NSEP telecommunications services, President Ronald Reagan established the National Security Telecommunications Advisory Committee (NSTAC) by Executive Order (E.O.) 12382 on September 13, 1982. The NSTAC provides the legal framework for joint industry/ government planning for NSEP telecommunications.[illegible] At a series of meetings in 1982 industry and government representatives identified the need for an authoritative entity to coordinate initiation and restoration of NSEP telecommunications services. This requirement led to the development of the concept of a National Coordinating Mechanism (NCM).

To a large degree, government NSEP communications planning had relied on the planning and response capabilities of a highly integrated domestic telecommunications industry dominated by the Bell System. However, structural and technological changes within the industry, including the impending breakup of the Bell System, and recognition of the increasing importance of telecommunications to national security and emergency preparedness, focused new attention on the Federal government's own telecommunications planning, management and response capabilities.[28]

The National Coordinating Center. In February, 1983, the Industry Executive Subcommittee (IES) of the NSTAC convened a meeting of its Emergency Response Procedures Working Group to address the NCM. Subsequently, the NSTAC recommended to the President that an industry and government-staffed National Co-ordinating Center (NCC) be created as the operational arm of the NCM.[29]

The NCC was officially established on January 3, 1984 with eleven telecommunications industry entities and the United States Telephone Association participating, together with representatives of the NCS. The NCC is a joint industry-government operations center whose general mission is to assist in the initiation, coordination, restoration, and reconstitution of NSEP telecommunications services under all conditions.

NSEP Forecast. In 1984, the President, recognizing the evolutionary nature of the NCS, signed E.O. 12472 which established an NCS comprising the telecommunications assets of its 22 member organizations. E.O. 12472 created a new NCS administrative structure comprised of an Executive Agent, a Manager, and a Committee of Principals, and also revised the NCS mission and organization.

The NCS now functions to assist the President, the National Security Council, the Director of the Office of Science and Technology Policy, and the Director of the Office of Management and Budget in the exercise of wartime and non-wartime emergency powers as contained in Section 706 of the Communications Act of 1934, as amended.[30]

The budget for NSEP telecommunications systems, as advocated by both the NCS and FEMA, will continue to be substantial until current NSEP programs are completed. Secure and survivable telecommunications will be required increasingly by Federal Agencies as their contribution to the NCS national program. Because of the nature and security classification of these systems, they may have a low public profile.

Major Trends And Issues

Government Procurement of Telecommunications

The FTS 2000 program will be the test of whether the Federal government can procure telephone service in the current competitive environment and realize savings compared to ownership and management of a system. The more vendors that are brought into the service contract and the more distributed the parts of the system, the more government involvement becomes necessary in the management of the network. This is in opposition to the original concept of a one-vendor, government hands-off telephone network.

The Federal government spent approximately $27 billion on radiocommunications equipment in 1987.[31] The government historically spends about 50 percent of the national total for this category of electronic goods.[32] It is estimated that at least $80 billion worth of equipment and systems exist, creating a large sunk cost. This sunk cost maintains an inertia with respect to Federal government spectrum usage.

It is expected that the funds allocated to the Department of Defense will decrease in the coming years. Normally, a decrease in total funding would result in a corresponding decrease in telecommunications goods procured by the defense establishment. However, the use of telecommunications as a "force multiplier" and the greater use of telecommunications in weapons systems and military platforms may result in electronic equipment procurement levels in the future similar to those for fiscal years 1987 and 1988.

Technology

A trend in military radiocommunications systems is towards embedded automation and signal processing techniques to improve information exchange. Emphasis in new design is to be able to operate in a radio interference environment, and to provide maximum tuning ranges to permit assignment flexibility in different regions of the world. Experimental work continues at extremely high frequencies in both equipment design and radio propagation sciences. Data transfer requirements placed upon tactical radio relay systems have increasingly driven bandwidth, interoperability and flexibility in supporting computer techniques, such as time division multiplexing and packet switching.

Advances in electronic solid-state technology are allowing economical use of frequencies above 20 GHz for short-haul radio-relay transmission. This spectrum availability, however, may be offset to some degree by the encroachment of consumer electronics into government-exclusive and shared frequency bands.

Since technology can, on one hand, create demand for spectrum, and on the other, open up new frequency bands for use, the application of technology must be balanced. Research and development should be focused on the development of technologies needed to satisfy the increased government requirements for radiocommunication services.

Federal Telecommunications Usage

The Federal government's use and reliance on spectrum-dependent radio systems to support the various government operations will continue to grow. Defense systems, including radar/detection systems, will be responsible for the majority of the growth in expenditures for the next few years. Federal government use of commercial land mobile systems, including cellular telephone, will expand. government-owned land mobile systems will employ trunking and other new technologies to make efficient use of the spectrum. The HF bands, long neglected, are emerging as the backup for critical command and control networks due to new automatic link establishment techniques, and the sharing of HF resources among government Agencies.

The Federal agencies are increasingly using telecommunications in innovative ways to better provide their services to the public. Three areas will be emphasized in the future. The first will be increased electronic access by the public to government data bases, bulletin boards, and other sources of important information. The second area is increased electronic communication between the public and the government, such as the filing of income tax returns. The third is electronic financial transactions, ranging from simple funds transfers to "smart cards" allowing for charging medicine and other health care-related items directly to the government.

Federal Spectrum Management

The acquisition and use of radiocommunication facilities are essential to accomplish the wide variety of individual and interrelated missions of the Federal Agencies which serve the public in many ways. Futhermore, the essentiality of the facilities themselves is established through the government's budget and appropriation procedures pursuant to congressional approval and Presidential direction. Therefore, as long as spectrum regulatory agencies do not question the spectrum requirements, the basic management question is not whether the spectrum should be used to support these activities but how it may best be used to meet the requirements to which the Agencies are committed - taking into account affected occupants of the same spectrum, present and future, national and international.

While spectrum is free to all users, the use of spectrum-dependent systems as opposed to wireline systems will be based on the cost of the equipment. As the spectrum becomes more scarce, the economic equation may, of necessity, include a cost associated with spectrum use to insure spectrum availability for those requirements that have no viable alternatives.

Increased demand for the spectrum resource, particularly by the private sector, will force an increased level of sharing, both among differing radio services in a common frequency band, and between government and private-sector users. Systems using spread-spectrum modulation, and systems which operate in multiple radio services on the same frequency will become more prevalent, and will present challenges for future spectrum managers. The critical question is whether the current spectrum allocation and regulatory process will be capable of satisfying the increased demands for radiocommunications services in an environment of intense competition for spectrum.

Finally, the increased use of fiber optic cable as an alternative to radio frequency systems will free some spectrum. Nonetheless, emphasis must remain on better management of the electromagnetic spectrum, to insure effective and efficient use of this resource. Sharing telecommunications assets among Federal users, such as common trunked land mobile systems serving several agencies, and technological advances allowing narrower channel spacings, are some of the tools the spectrum managers must use effectively in planning and managing the electromagnetic environment in the year 2000.

Notes

1. Meeting Public Demands: Federal Services in the Year 2000, Office of Management and Budget, January, 1988

2. The term wire-line is used here as those services that are not primarily radio systems, realizing that many wire-line systems use radio transmission, including satellite systems, as part of the transmission path.

3. The Department of Energy, the National Aeronautics and Space Administration, and the Federal Aviation Administration are examples of agencies with extensive telecommunications networks.

4. The Federal Telecommunications System (FTS) Intercity Program Changes in the 80's, Office of Information Resources Management, General Services Administration, February, 1984

5. Military Fiber Optics News, May 13, 1988, Pg.8

6. The Washington Post, August 10, 1987

7. GAO Report, GAO/IMTEC-87-42

8. Communications Daily, November 2, 1987

9. Interview, Mr. Gary Kowalczyk, GSA, July 20, 1988

10. Defense Communications Agency, FY1987 Annual Report.

11. NSEP telecommunications are telecommunications services which are used to maintain a state of readiness or to respond to and manage any event or crisis (local, national, or international), which causes or could cause injury or harm to the population, damage to or loss of property, or degrades or threatens the NSEP posture of the United States.

12. Global Automatic Voice Network, Defense Communications Agency, DCA Circular 310-V55-6, 1980

13. Semi-Automatic Ground Environment/Backup Interceptor Control

14. Now the Defense Advanced Research Projects Agency (DARPA)

15. Tanenbaum, A.S., Computer Networks, 1981

16. Communications Week, August 10, 1987

17. MODEM: MOdulator/DEModulator

18. Meeting Public Demands: Federal Service in the Year 2000, Office of Management and Budget, January, 1988

19. A Summary of the Federal Government's Use of the Radio Frequency Spectrum, U.S. Department of Commerce, NTIA, July 1988

20. Communications Act of 1934, as amended, Section 305 (a)

21. NTIA, U.S. Department of Commerce

22. Conterminous United States.

23. Identification Friend or Foe.

24. LOng RAnge Navigation

25. President Reagan made this announcement on Veteran's Day, November 11, 1987.

26. NTIA Manual, Section 2.3.6

27. National Communications System Annual Report

28. Mitre Corporation Working Paper WP-85W00086, Subject: Joint NSEP Telecommunications Planning, March 1985.

29. Draft NCC Operating Charter dated April 3, 1984.

30. Executive Order 12472, Office of the President.

31. U.S. Industrial Outlook 1988, U.S. Department of Commerce, International Trade Administration

32. Current Industrial Reports, U.S. Department of Commerce, Bureau of the Census, Report series MA-175

VIII

Postal Services

by Roger K. Salaman

Postal service is the transportation of mail, including letters, documents, and packages, from one addressee to another. It is an essential component of the economic and social fabric of the nation, carrying business transactions, correspondence, news, and small gifts and products.

The United States Postal Service (USPS) is the largest and oldest institution providing postal services in this country. In 1986, it delivered 147 billion pieces of mail to over 100 million addresses 302 days a year.[1] On average, every adult and child in the country receives 2 pieces of mail at each delivery, about 15 pieces of mail per household per week.[2]

The majority of the mail, 83 percent, is originated by business. Sixty two percent is received by households.[3] Over half the mail (55.5 percent) is sent from business to households. Only 11 percent of the mail goes from households to business.

The USPS employs three-quarters of a million people--25 percent of the total Federal Government employment--with an average annual salary of $25,567[4]. Only General Motors and the Department of Defense employ more people. The Postal Service is the ninth largest "corporation" in the United States, surpassed only by Sears Roebuck as a retailer.[5]

The USPS budget of $30 billion (for 1986) is recovered from user fees, postage, and a Congressional appropriation. This appropriation has decreased from 20 percent of Postal Service operations before reorganization in 1970, to 2.5 percent in 1986. The current $750 million appropriation is equivalent to a penny increase in First Class postage.

Contrary to popular belief, the U.S. Constitution does not require, but rather authorizes the U.S. Government to provide postal services. A Government postal service has been so authorized since six months after adoption of the Constitution, but with somewhat less of a mandate than "The sole and exclusive right and power ..." commitment of the Articles of Confederation. The Government postal organization has a statutory monopoly in the category of mail defined as "letters."[6]

Private sector postal services span a large segment of the postal service market. Part of this market is stimulated by the suspension of the Private Express monopoly for time sensitive letters and data processing documents. However, even without this suspension, private carriers can carry letters if the envelope contains the appropriate postage. In this way, private carriers provide services that add value beyond those available from the USPS. This can include either the carriage of letters or the introduction of the material into the mailstream where appropriate.

Private parcel service is the largest private postal business, with about $9 billion in revenues. Other private postal services include delivery of national newspapers and magazines[7], bus and airline transportation services, and private post office boxes.

Key Industry Statistics

The postal industry has about $44 billion in revenue, $30 billion of it is attributed to the United States Postal Service (USPS). The industry employs over three-quarters of a million people with USPS employment in 1986 at 784,557 (606,029 being full-time employees). The USPS is very labor intensive, with 83 percent of its expenses in labor and only 8.2 percent in the next largest component, transportation.[8]

TABLE 1
United States Postal Service
Mail Volume and Revenues

Classified Mail Volume
(Pieces in billions)

	1986		1976		1976-1986 Change
	Volume	(%)	Volume	(%)	(%)
1st Class	76.2	51.7	52.5	58.7	45
2nd Class	10.6	7.2	9.5	10.6	11
3rd Class	55.1	37.4	22.5	0.8	144
4th Class	0.6	0.4	0.8	0.8	- 92
Total Volume	147.4		89.7		

Classified Mail Revenue
($ Millions)

	1986		1976		1976-1986
				Change	
	Revenue	(%)	Revenue	(%)	(%)
1st Class	18,035	64.4	6,734	62.0	168
2nd Class	1,356	4.8	589	5.0	143
3rd Class	6,154	22.0	1,815	16.5	239
4th Class	845	3.0	766	7.0	10
Total Revenue	30,102		10,762		

The market power of the USPS stems from both tradition, and its Government-granted monopoly in the category of mail called "letters." Letters (categorized as First Class mail) account for about half the pieces of mail handled and about two-thirds of revenue as shown in Table 1. The two basic changes in the character of mail are the increase in Third Class mail and the decrease in the Fourth Class parcel post market.

The consumer generally considers Third Class mail as "junk mail." This perception is not shared by industry, which increasingly uses this reduced-rate class to send advertising material. Nor is it looked down upon by the USPS, which sees growing revenues in this class of mail. As shown in Table 2, direct mail advertising expenditures are exceeded only by newspaper and television advertising.[9]

TABLE 2
Distribution of Advertising Media

Medium	1970	1985
Newspapers	29.2	26.5
Magazines	6.9	5.6
Television	18.4	21.9
Radio	6.7	6.9
Direct Mail	14.1	16.4
Business Papers	3.8	2.5
Outdoor	1.2	1.0
Miscellaneous	19.7	19.2

Third Class mail comprises over one-fifth of USPS revenues, over one-third of its mail volume (see Table 1), and 40 percent of the mail weight. In contrast to the residential "public service" perception of mail, over 80 percent of the mail is sent by business; less than 20 percent is sent by households.[10] Sixty-two percent of the mail is entered by businesses at post office docks or other bulk mail areas, in contrast to 28 percent given to the carrier or dropped in collection boxes. Only one-quarter of the mail carries stamps--in contrast to meter or permit imprints used by businesses.

Bulk mail provides the customer with price incentives to perform work that would otherwise be done by the Postal Service--such as mail sorting. The tendency in the postal industry, as well as in telecommunications and other industries, is to unbundle services, allowing the users to better match their specialized needs, and the service providers to concentrate on what they do best.

Because USPS parcel rates have been held high, it has not been a strong competitor in Fourth Class mail. As seen in Tables 1 and 3, the USPS share of the parcel market has decreased significantly.

The revenues of the USPS reflect both social and economic trends in the nation. The demand for First Class mail increases with good economic conditions. There are three factors that cause a concentration of costs, revenues, and work load. As might be expected, because of the distribution of population in the country, the majority of USPS revenues are obtained by a few post offices. Thirty percent of the mail originates at the 10 largest post offices in the country. These post offices accumulate 14 percent of revenues and have 13 percent of the employees. Fifty percent of the mail originates in the 22 largest post offices, which acquire 21 percent of the revenues and have 20 percent of the total employees of the Postal Service.[11]

TABLE 3
Change in Mail Volume Since 1979

Year	First Class	All Other Classes	Fourth Class
1980	10.4	5.1	3.3
1981	21.1	6.0	- 3.9
1982	33.5	7.1	- 2.9
1983	48.0	8.9	- 7.6
1984	75.3	15.5	- 2.5
1985	89.6	22.1	- 6.3
1986	100.1	28.3	- 2.0

In addition, a few very large mailers provide significant mail volume. For example, the 120 companies with national accounts contribute about $8 billion per year in postal revenue.[12] Finally, there is a very significant increase in mail volume near holidays--particulary at the end of the calendar year.

The United States Postal Service provides several mail services and other services beyond the four classes discussed above. The total USPS offerings are shown in Table 4. The distribution of the small income from the Congressional appropriation is also shown. These funds are earmarked to benefit specific mail classes--nonprofit, educational, and library organizations, and free mail for the blind and handicapped.

As shown in Table 5, there is little doubt that the U.S. Postal Service has decreased dependence on Congressional appropriations since implementation of its reorganization in 1971. Yet the Congress has continued to closely monitor Postal Service operations each year relative to general and special interests.

The general decrease in its financial strength in the late 1970's raised the question whether the USPS could in fact remain a viable organization while maintaining the objective to be self-sufficient. USPS financial trends in recent years provide encouragement in meeting this objective. It also appears that the increase in postage compensated for inflation, as measured by the Consumer Price Index (CPI), with the decreased subsidy apparently absorbed by increased efficiency or decreased service.

Because of the USPS monopoly position, the mail rates are regulated by a separate Government body--the Postal Rate Commission. Table 6 indicates the economy of USPS First Class mail rates relevant to that in other developed countries.[13]

The postal and telecommunications industries have many similarities. For example, the national policies for both services, as stated by their respective statutes, are concerned with providing communications to all the people at reasonable cost.

TABLE 4

USPS Business Summary

Type of Service	Number of Pieces (thousands)	Total Income ($ millions)	Appropriation Subsidy Include ($ millions)
First Class Mail	76,186,648	18,034.9	
Priority Mail	329,896	1,010.7	
Express Mail	40,095	490.8	
Mailgram	25,540	17.5	
Second Class Mail (TOTAL)	10,587,904	1,356.0	133.7
Within-the-county		147.7	53.8
Outside-the-county			
Nonprofit Publications		235.8	56.1
Classroom publications		6.3	1.7
Regular-rate publications		958.0	22.1
Fees		8.2	
Third Class Mail (TOTAL)	55,048,946	6,154.3	548.0
Single-piece rate		149.4	
Regular bulk rate		4,670.5	
Nonprofit bulk rate		1,291.1	548.0
Fees		43.3	
Fourth-Class Mail (TOTAL)	602,006	845.0	30.7
Parcels (zone rate)		404.5	
Bound printed matter		145.6	
Special-rate matter		213.0	
Library materials		79.0	30.7
Fees		2.9	
International Surface Mail	315,734	220.9	
International Air Mail	481,993	713.2	
U.S. Government (TOTAL)	3,721,568	992.5	
Franked	751,769	96.1	
Penalty	2,969,799	896.4	
Free mail for the blind	32,475	37.9	37.9
TOTAL MAIL REVENUE	147,375,805	29,123.4	750.3
Registry	52,348	167.4	
Certified	147,374	202.9	
Insurance	39,783	50.3	
Collection-on-delivery	10,384	19.5	
Special Delivery	10,232	30.4	
Money Orders	133,799	134.6	
Other			
Box rents revenue		258.6	
Stamped envelope		14.7	
Other		100.1	
TOTAL OPERATING REVENUE		30,102.1	

TABLE 5
Financial Indicators

			Price of 1st Class Stamp*	
Year	Appropriation (Percent)	Equity (Million)	Actual	Deflated For CPI
1969	15.1	1,150		
1970	19.4	1,538		
1971	23.8	1,686	8	8.0
1972	15.3	1,548	8	7.8
1973	15.1	1,566	8	7.6
1974	16.3	1,147	10	7.1
1975	13.3	190	10	7.6
1976	13.2	(950)	10,13	7.3,9.3
1977	11.7	(588)	13	8.8
1978	10.9	(945)	13,15	8.3,9.3
1979	9.6	(444)	15	8.6
1980	8.4	(719)	15	7.6
1981	6.1	(1,307)	15,18	7.1,8.2
1982	3.0	(505)	18,20	7.9,8.3
1983	3.3	112	20	8.2
1984	3.3	311	20	7.9
1985	3.3	58	20,22	7.7,8.2
1986	2.5	362	22	8.1
1987			22,25	7.9

(* Two numbers indicate price before and after rate increase)

TABLE 6
Comparison of First Class Mail Rates

Country	First Class Rate (Converted to U.S. Cents)
Italy	39.7
Federal Republic of Germany	39.5
Japan	38.9
Austria	38.6
Norway	33.9
France	32.2
Netherlands	30.6
Sweden	30.4
Switzerland	30.3
Belgium	28.6
United Kingdom	24.6
Canada	24.5
Australia	22.6
United States	22.0

Federal law states that, "The Postal Service shall have as its basic function the obligation to provide postal services to bind the Nation together through personal, educational, literary, and business correspondence of the people. It shall provide prompt, reliable, and efficient services to patrons in all areas and shall render postal services to all communities. The cost of establishing and maintaining the Postal Service shall not be apportioned to impair the overall value of such service to the people."[14] As for telecommunications: "For the purpose of regulating interstate and foreign commerce in communication by wire and radio so as to make available, so far as possible to all the people of the United States a rapid, efficient, Nationwide, and worldwide wire and radio communications service with adequate facilities at reasonable charges..."[15]

A summary comparison of the USPS and the telephone industry is contained in Table 7.[16] There are a number of similarities between the postal and telephone industries. Both the number of post offices and telephone switching centers are decreasing. In both industries, the cost of the service is paid by the sender. The trend is toward decreasing the domain of the monopoly in both industries. They both function under economic regulation, and they are moving toward cost sensitive pricing.

The most striking difference between the postal and telephone industries is the trend toward cheaper telephone service and more expensive postal service. The telephone industry has over three times the revenue income of the USPS. Yet the number of employees and labor expense is roughly the same ($25 billion for the USPS versus $20 billion for the telephone industry). This indicates that the telephone industry is much more capital intensive. This capital investment in the telephone industry is used for new technology investments that have allowed productivity to outpace inflation. Therefore the message rates for telephone service are decreasing, whereas they are increasing for postal service. In 1988, the cost of the First Class postage stamp will be equal to that of a nighttime telephone call anywhere in the United States.

Reorganization of the postal and telecommunications industries, in 1971 and 1984 respectively, had significant impacts on these industries. The more competitive telephone industry, driven by deregulatory forces, continues to drive productivity and efficiency. The number of postal and telephone employees decreased after their respective reorganizations. The 25 percent decrease in telephone employees since 1981 (stimulated by the likelihood of reorganization) contributed to continued productivity since divestiture. Although there was a decrease in USPS employees immediately after reorganization, the 15 percent increase in the last 10 years has exceeded the decrease after reorganization. The number of USPS employees now exceeds the previous peak established just before postal reorganization. In contrast to the postal industry, there have been sufficient technology advances in the telephone industry to outpace the increase in service volume.

TABLE 7
Postal and Telephone Industry Comparisons

Notes	Postal Industry	Telephone Industry
GENERAL		
Employees	785,000	935,000
Revenues	$30 Billion	$110 Billion
Average Hourly Wage	$14.14	$13.16
Capital Expenditures	$2.4 Billion	$25 Billion
Average per person per day	2.1 pieces of mail	5.4 conversations
Postal Deliver Points/	90 Million	
Switched Telephone Lines		78 million
Household Penetration	99 Percent	92 Percent
Annual Base Cost of Service	$118 door $83 curbline $71 centralized	$54-216 Residential $192-648 Commercial
Plant	29,344 Post Offices	19,228 Cental Offices
MONOPOLY SERVICE		
The necessity and extent of the monopoly continues to be an issue n both industries	Nationwide letter mail sorting service and distribution	Local franchised switched telephone service and distribution
EXEMPTIONS		
In both industries, regulators have allowed competition sometimes where adequate service was not available from the monopolist	Time sensitive material	Specialized carriers
ECONOMIC REGULATION		
Both industries claim economies of scale and have concerns of cream-skimming and carrier of last resort	Break-even	Rate of Return; some alternatives
UNBUNDLED COST SENSTIVE PRICING		
Both industries continue to move toward cost-based pricing of services.	Presort Mail Bulk Rate Mail	Usage sensitive pricing Bulk rate service Inside wiring equipment
NEW TECHNOLOGY		
Both industries are using new electronic technology to improve services. The telecommunications industry is also using it to offer new services.	Optical Character Readers Bar Code Sorters Robot Mail Handling Light-weight Delivery vans	Digital transmission and switching Photonic switching Fiber Optics

Current Issues

Private Express Monopoly

The Private Express Statutes provide the U. S. Postal Service with a monopoly to carry "letters" for a fee over post routes. The initial Private Express law was passed in 1792. The definition of post routes has been expanded over the years to include any route over which mail might be physically transported. These statutes provide the USPS with an economic monopoly. That is, the USPS obtains the required postage for letter mail even if it is physically carried by someone else.[17]

The meaning of the word "letter" has been modified as technology and new private sector offerings emerge. The USPS has continued to issue memoranda to inform the public of the extent of its monopoly. The trend of the USPS has been to define the "letter" to include new hard copy services. In balance, the Postal Service continues to suspend the "letter" monopoly consistent with private, public, and Congressional pressure concerning the private delivery of specific material. The reasonableness of the monopolist defining the extent of its monopoly has been questioned. Congress has taken little formal action to clarify the extent of the monopoly.

The last significant revision of the Postal Service interpretation of its letter monopoly was in 1981. Among other changes, the Postal Service at that time suspended time-sensitive material from prosecution under the Private Express Statutes. The most significant exemptions to the statute are:

- time-sensitive material
- messenger delivery
- letters that have postage affixed and canceled by the sender
- identical letters sent in bulk to a single address
- books or catalogues
- data processing materials
- letters that relate exclusively to some part of the cargo
- letters that enter the mainstream before or after private carriage
- nonmailable matter

Two considerations should be noted regarding the changes occurring in the USPS monopoly. First, other postal industry participants quickly responded to the needs of business transactions by providing express services that were not being accommodated by current postal services. The USPS soon became a competitor by offering its own express mail service. The same phenomenon occurred in the telphone industry as it was opened to competition. For example, certain data transmission services were offered by specialized carriers, where these services were not available from the telephone monopoly carrier.

Second, the speed of business operations has accelerated to the point where lectronic communication has become not only a viable, but an essential alternative o previous First Class mail service. The potential of new electronic communication apabilities is changing the way businesses conduct their transactions. Electronic ellow pages and television buyers' channels are becoming replacements for mail rder catalogs. This transition has only started--its impact on hard copy postal ervices has yet to be realized.

Competition

The USPS is encountering competition from electronic communications and rom private carriers of the mail.[18] The USPS estimates that 45 percent of its mail olume and 21 percent of its revenues are most vulnerable to competition.[19] This ompetition is in Second Class, Third Class, and Special Rate Fourth Class mail.[20] Significant competition also exists in expedited mail (including time-sensitive delivery of documents and parcels) and international mail.

There are upwards of 10,000 competitors of postal services[21]. Six primary ompetitors are listed in Table 8.

TABLE 8
Revenues of five USPS Competitors

Company	Revenue ($ Million)	Volume (Million)
United Parcel Service	7,700	2,000
Federal Express Corp.	2,000	105
Emery Air Freight Corp.	876	13
DHL Corporation	700	
Purolator Courier Corp.	611	90
Airborne Freight Corp.	466	20

The customer incentive to select a competitor to the USPS is generally based on either price or better service, including speed of delivery. The cost advantage of a small competitor entering this business is the small capital outlay required (or incremental cost over a service currently provided), and, for startups, the use of part-time personnel (such as retired people, homemakers, and youths) who are seeking supplementary income and no fringe benefits. More established competitors, such as the United Parcel Service and Federal Express, provide extensive geographic coverage and a full menu of services.[22] Competitors generally service a limited market (mainly high density areas with a specialized service).

The primary competition to First Class mail has been electronic messages, time-sensitive material (a recent exemption to the Private Express Statutes), and delivery of mail by the originating company (such as utility bills). Competitive electronic message systems include:

- telephone conversations
- data messages (such as Telex services)
- computer-based message services
- communicating word processing
- facsimile communications
- voice mail.

The electronic transfer of funds (EFT) (which includes transferring funds between banks, obtaining and depositing of funds, and payment of bills) is also on the rise, drawing business away from the traditional use of First Class mail. There are now 31 interconnected automated clearing houses covering the entire United States for the purpose of transferring large volumes of funds such as Social Security payments[23] and private pension payments. The Automated Clearing House (ACH) volume has grown from 51 million transactions in 1976 to about 770 million in 1985. Over 34,000 firms and government organizations are now handling transactions via the ACH system.

Preauthorized payments by customers of recurring bills, such as life and health insurance premiums and home mortgage payments, are also enhancing the use of EFT systems. For example, Equitable Life Assurance Society collects about half a million, and New York Life Insurance about one million premiums via EFT. There are about 57,000 Automated Teller Machines nationwide that substitute for either personal or First Class mail delivery of funds.

The market that includes both time-sensitive material and Priority mail[24] has been particularly attractive to competitors. This includes both the express mail carriers (as mentioned above) and courier services that generally operate as bicycle services within metropolitan areas. Because of both higher rates and increased private sector competition, the USPS had its first decline (8.7 percent) in Express mail volume in 1986.[25] In addition to express type mail, some companies (notably utility companies) have been experimenting with delivering bills at the same time they read the meters.

A primary USPS concern about competition in Second and Third Class mail regards piggyback advertisements. Private companies combine the delivery of magazines and newspapers at a reduced cost by delivering advertisements for other companies at the same time. For example, the delivery cost of 15 cents for a magazine could be reduced 2 cents for each advertisement that is delivered at the same time.

One of the greatest sources of competition is in Parcel Post service. Between 1967 and 1985, the USPS parcel volume dropped 79 percent. In 1985 and 1986, this volume decreased 8.3 percent. USPS parcel rates have been held high due to pressure on the Postal Rate Commission and the Congress by competitors.

Finally, the USPS has had significant competition from international electronic message services and private businesses who aggregate foreign mail. Remailer and mail consolidators aggregate foreign bound air mail or Second or Third Class mail, transport it in bulk, and submit it for foreign posting at the destination cation.[26] In August 1986, the Postal Service suspended the Private Express Statutes permit remailing in response to a Board of Governors determination that emailing is in the public benefit. In the same year, the USPS volume of outgoing ternational mail dropped 4 percent.

Electronic Mail

The USPS has offered three primary services that use electronic ansmission. A service called Mailgram is offered in conjunction with Western nion. Messages are received in electronic form and forwarded to a destination post ffice for printing and inclusion in the First Class mailstream. Mailgram volume has ontinued to decrease with a drop of 18.5 percent from 1985 to 1986 due to ompetitive alternatives.

A more expansive system called ECOM was established in 1982. ECOM was perated by the Postal Service. It allowed many parties to send messages to a post ffice for nationwide transmission and inclusion in the First Class mailstream. ECOM was short lived because of political pressure related to potential competition ith similar private service systems. In June 1984, the Board of Governors decided hat the postal Service should dispose of the ECOM system.[27]

INTELPOST, initiated in 1980, is an expanding international service perated cooperatively with foreign postal services. It is a store-and-forward acsimile system with the hard copy message entered into the mailstream at the estination post office. In late 1984 the telecommunication circuits were changed rom dedicated channels to a dial-up operation using the public switched telephone etwork. Although it is also similar to existing services of U.S. companies, little oncern has been raised about negative competitive impacts.

Organizational Issues

A continuing question is whether the USPS should be maintained as a Government enterprise or made a private corporation[28]. The organizational nvironment determines the firm's incentives. As a private business, the main mphasis is on efficiency. As a Government agency, the emphasis is on meeting ocial needs. The original incentive for the Government to transport the mail was to rotect the privacy of letters.[29] The next argument for Government control was the eed to subsidize certain classes of mail as a social good. Today, with the Congressional subsidy of only 2.5 percent of postal revenues, and the self-sustaining ncentives set forth in the Postal Reorganization Act, the Postal Service operation has een oriented more toward business efficiency.[30]

In 1970, the Post Office Department was reorganized.[31] On July 1, 1971, it ecame the U.S. Postal Service, an independent organization within the executive ranch[32]. The Postal Service continues to operate at a break-even point between xpenses and revenues. Increased expenses mean the need to increase the cost of ostage. The Service must balance the conflict between the objectives of efficiency and social services, even with the dwindling public welfare appropriation by Congress. This may become more difficult with the expected loss in price elasticity, with telephone rates becoming comparable to postal rates.

Rate Issues

The USPS, being a break-even organization, lacks strong incentives to become creative. The Postal Reorganization Act requires that income "will equal as nearly as practicable" costs of the USPS and still maintain a reasonable degree of rate stability. The USPS has operated in the black for half of the last 10 years.

Arguments have continually been raised about alternative revenue methodologies, including placing part of the burden on the recipient of the mail. Regardless of this methodology, there is little incentive to improve productivity in this break-even environment.

Although the Postal Service must determine rates based on direct attribution of expense as much as possible, there are continual questions of cross subsidization between and within mail classes.[33] These issues are similar to those continually raised in the telephone industry.

Critical Industry Developments

A U.S. Government-run postal service has operated since colonial times. The Constitution of the United States authorized, but did not mandate, the Government to maintain a postal service. It was maintained as a Government activity, not because of the lack of interest by private competitors, but to secure the privacy of the mail[34]. A brief chronology of the U.S. Government postal service is contained in Table 9.

The Government post office was a temporary office, established by legislation in 1789. It was not until 1872 that the Post Office Department was specifically established by Congress as an Executive Department.

The Post Office played a leading role in both westward expansion and development of national sources of transportation. Mail was the only source of distant communications before availability of the telegraph. Its service subsidized development of steamboat, railroad, and airplane transportation. Historically and by policy direction, mail service has provided a mainstream of communications that binds the nation together.

Until the 1850's, home delivery was arranged by the recipient of the mail, who paid a carrier a penny or two for home delivery. Between 1858 and 1863, home delivery was free to the recipient--that is, subsidized by the taxpayer. Rural Free

Delivery was implemented in 1896. Throughout its recent history, the Post Office provided services other than mail, such as postal savings, money order, and passport services.

In the late 1960's, it became apparent that the Post Office Department was in serious management and financial trouble. This was punctuated by the logjam stoppage of mail at the Chicago Post Office in 1966. Hearings began in 1967 to rectify this situation. In 1968, a Presidential commissioned report proposed a major restructuring of the Government postal service[35].

In March 1970, a widespread postal work stoppage began over disagreements in postal pay. In August, the President signed a bill to reorganize the Nation's governmental postal service, largely consistent with Post Office Department, union, Congressional, and the Kappel report recommendations. The new U.S. Postal Service began operation on July 1, 1971. A primary objective was for the Postal Service to operate in a more businesslike, economically self-sufficient manner.

Major accomplishments since the reorganization include:

- decentralized management of operations;

- abolishment of political patronage in selecting postmasters and rural carriers, replacing it with a merit system;
- achievement of the first labor contracts of collective bargaining in the history of the Federal Government;

- termination of the Federally appropriated public service subsidy.

TABLE 9
Chronology of Governmental Mail Services

1639 - Massachusetts establishes first post office in the colony
1775 - Benjamin Franklin, first Postmaster General
1789 - Temporary Government Post Office established
1829 - Postmaster General became Cabinet post
1832 - Railroad first used for mail transportation
1847 - Postage stamps authorized
1855 - Registered Mail
1855 - Compulsory prepayment of postage by sender
1858 - Street letter boxes
1860 - Pony Express
1861 - Pony Express service terminated
1863 - Free City Delivery
1864 - Railroad Post Offices
1864 - Domestic Money Orders
1872 - Post Office Department established by Congress
1885 - Special Delivery
1902 - Rural Free Delivery made permanent
1910 - Postal savings banks established
1911 - Airplanes first used for mail transportation
1913 - Parcel Post service
1913 - Collect-on-Delivery service
1918 - Air Mail
1920 - Metered Postage
1926 - Post Office transferred air navigation equipment to Commerce
1950 - Deliveries reduced to one a day for residences
1955 - Certified Mail
1963 - ZIP Code Program
1964 - Self-Service Post Offices
1965 - Optical Scanning of ZIP codes
1966 - Postal Savings terminated
1967 - Mandatory presort by ZIP for second and third class
1968 - Priority Mail
1970 - Mailgram
1970 - Postal Reorganization Act passed
1971 - U.S. Postal Service established, PMG not cabinet post
1971 - First national service standards established
1972 - Passport applications accepted nationwide
1977 - Air Mail abolished as separate rate category
1977 - Express Mail
1977 - Railroad Post Office terminated
1980 - INTELPOST electronic message services established
1982 - ECOM electronic message service established
1983 - ZIP + 4
1983 - End of Public Service Subsidy
1984 - First automation of postal windows

Major Trends and Issues

The USPS alone carries about 150 billion pieces of mail per year, with about half being letter type First Class mail. The private sector carries billions of pieces more--providing the majority of the parcel industry and increased express mail services. The postal industry in aggregate thus provides a vital nationwide network for delivering hard copy messages, documents, and small packages. The nation's commerce would come to a halt without these services--as evidenced by the few mail stoppages that have occurred.

But the postal industry is also an important thread in the nation's social fabric. Historically it contributed significantly to western expansion of the nation. Today, postal and telephone communication independently satisfy business and social needs--telephone with instantaneous communications, and letters for hard copy messages. The telephone industry serves 86 percent of the message market share in contrast to the 14 percent for First Class mail.[36] Obviously, there is no electronic substitute for the over 2 billion small packages delivered each year to households and businesses.

International mail continues to be an important component in international trade, although the USPS is losing market shares to private carriers and electronic communications. With the growth markets largely in information services, electronic communication is favored where international communication networks provide more favorable rates, such as those developed by international corporations.

An update to the USPS Strategic Business Plan indicates that the combined telephone and postal message market will increase an average of 5.6 percent per year for the next 5 years.[37] The postal business is expected to expand to about 170 billion pieces by 1990.

Several factors are stimulating even a brighter future for growth in electronic communications as they compete for the nation's message market. First, there is an increasingly favorable comparison between the cost of a telephone call and postage. With the increased cost of the First Class stamp in 1988, postage will, for the first time, be equal to the reduced night rate of a one-minute telephone call. Second, with the diversity of equipment and service due to a) telephone industry deregulation, and b) a population that is becoming computer literate, the ability to access and communicate information is stimulating new telecommunications markets. Local and long-distance access to information and electronic mail is becoming commonplace in business and even at home with the younger generation graduating from public schools where over 85 percent of these schools now provide instruction on use of computers.[38]

The future of the First Class monopoly component of the Postal Service may not be as bright. Postal rates will continue to increase in the traditional 3-year cycle, with increases in labor cost. The relative cost of electronic communication, however, is expected to continue to decrease. This will provide greater incentive for customers to move "letter" type mail electronically. The challenge in the long term is to provide the Postal Service with the structural environment that will allow it to adapt to the shift already seen toward nonmonopoly-protected mail classes while maintaining the incentive to continue to carry the remaining First Class mail.

Three interrelated issues continue to be raised about the Government's postal operation.[39] First, whether mail service in this country should be a public service or a business has been a long and continuing debate. The second issue is whether the Private Express Statutes should be abolished. The third issue is whether the Postal Service can be maintained as a viable entity in light of new emerging forms of communications.

Business or Public Service

The Reorganization Act of 1971 significantly moved the U.S. Postal Service toward being a business, but not entirely. The USPS is no longer a Cabinet-level department, but rather is an independent agency of the Federal Government. Even so, the President appoints 9 of the 11-member Board of Governors, who appoint the tenth member as the Postmaster General. These 10 members appoint the eleventh member as the Deputy Postmaster General. The President also appoints the five-member Postal Rate Commission that recommends postal rates and classifications for adoption by the Board of Governors.

Postal employees have, for the first time, the authorization for collective bargaining on wages and working conditions under laws applying to private industry, although they do not have the ability to strike.

Financially, the USPS has the authority to borrow up to $10 billion from the general public. The intent is for it to be self-sufficient, with the exception of what is now a small subsidy. Since 1982, the USPS has been able to maintain effective service nationwide, even to remote parts of the United States, without the need for the previous "public service" subsidy. The "revenue forgone" subsidy continues to decrease yearly--in 1986 being $716 million.[40]

This small Congressional subsidy has provided the vehicle for Congress to maintain annual review of the Postal Service and the Postal Rate Commission, as it does with other Government agencies.[41] The Congress has used this oversight for two purposes--first, to review the subsidy for special interest mailers and second, to review the management of the Postal Service. This review causes the Service to trade off efficiencies with special-interest driven oversight--as evident in Postal Service initiatives toward automation, appropriate parcel service rates, and electronic mail. Also, the intent that the Postal Service adjust rates to "break-even" does not provide the efficiency incentive found in private corporations.

The Private Express Monopoly

The Private Express issue is whether this monopoly must be sustained to provide prompt, reliable, and efficient services to patrons in all areas and at costs that do not impair the overall value of such service to the people.[42] There is little evidence that any private firm desires to deliver correspondence as extensively as the Postal Service. There has been continual encouragement for the Postal Service to eliminate its monopoly.[43]

Although First Class mail is largely protected by the Private Express Statutes, it is not protected against the decreasing cost of electronic communications. Fifty-one percent of the mail received by a household is the protected First Class mail. About 40 percent of the First Class mail received by households consists of bills and financial statements--ideally suited for substitution by electronic transmission.[44]

There are many areas where there are few or no acceptable substitutes for physical transportation of material in the foreseeable future. Certainly this includes the transportation of parcels. Also, electronic transmission of newspapers has not had widespread acceptance. Advertising through the mail continues to be competitive with newspaper, radio, television, and telemarketing alternatives. All of these mail categories have substantial competition in the private sector.

The primary question, however, is how long the Postal Service's letter monopoly, with continually increasing costs, can compete favorably with the decreasing cost of electronic transmission. In 1988, the cost of a letter will be 25 cents--equal to the cost of a 1-minute telephone call anywhere in the continental United States at night rates. The cost of a local call is less than 15 cents today,[45] and these costs are likely to decrease.[46]

Meeting the Total National Communications Needs

Previous forecasts of doom for the USPS, either because of institutional problems or the emergence of electronic communications have not materialized--at least not yet. The USPS is a growing business, as are private firms in the postal business. But the future is uncertain.

There is little doubt that the USPS provides an important function in this nation's communication infrastructure.[47] However, electronic communications has properties of speed and cost that will make it an increasing competitor for conveying information. The issue is how to maintain the unique attributes of both physical and electronic communications. It might be possible to draw upon the experience gained in deregulation of the telecommunication industry. If the USPS remains tightly regulated, restrained from introducing new technology, and constrained from entering new related business, the nation might lose the capability to offer hard copy delivery to all at reasonable costs. Postal costs might increase, for example, as First Class mail shifts toward electronic delivery. Incentives toward innovation in the telephone industry have increased appreciably with reduction in regulation and increased competition.

The problems attributed to competition between postal and electronic communications can be turned into opportunities by considering the emergence of an integrated communication industry. Modernization of the postal and electronic communication industry regulation has been parallel but independent in the past 20 years. An example is the trend in both industries toward cost-based pricing. Both have been shedding unnecessary Government regulations and the restrictions on competition. Both have the same economic goals and analysis techniques. Both are concerned with retaining universal service to the public at reasonable rates.

In spite of the fact postal and electronic communications are both in the business of advancing the nation's ability to communicate and disseminate information, the Government has maintained a dual, and in some cases a duplicate, regulatory and oversight structure. Arguments in the early 1980's over ECOM provides a good example of attempts to maintain jurisdiction over a service that required cooperation rather than separation. The postal and telecommunications industries both have independent regulatory commissions with similar public interest objectives and separate Congressional committees with very similar national policy statements. From the standpoint of Government efficiency, this separation has obvious drawbacks--including the duplication of Government staffs doing similar work but without the benefit of one another's experience.

But the greatest disadvantage of this separation is the lack of new services to the public because of artificial boundaries. The separate pieces of legislation have caused the creation of separate industry segments and markets. The United States has thus been unable to take advantage of the natural integration of hard copy and electronic communications to meet a diverse variety of business and personal communication needs. An obvious example of the loss of service capability is the discouragement of the USPS to integrate electronic and hard copy service (e.g., ECOM), and the reluctance of electronic communication service providers to initiate such a service because of the threat of the Private Express monopoly.

Although separate telephone and postal services are widely available, the user has only a very limited opportunity to select services that integrate electronic and hard copy communications. As one example, it is not possible at this time to send a message in either electronic or hard copy form and have it automatically delivered electronically to the recipient who has this capability, or otherwise delivered in hard copy form.

It would appear that the full potential of new services cannot be integrated into full service communications systems without removing the artificial separation of the postal and electronic communications industries. This merger would allow the natural formation of a common industry with the incentive to offer a full complement of services in a competitive environment.

Notes

1. U.S. Postal Service, Annual Report of the Postmaster General, 3 (1986)

2. In comparison, the total telephone conversations per day equate to 5.4 for each adult and child.

3. University of Michigan, Nonhousehold mailstream study, Final Report, Institute for Social Research, (1980). (Business includes nonprofits and government, who send only 11 percent of the mail.)

4. U.S. Postal Service, Comprehensive Statement on Postal Operations, (1986).

5. Fortune, The Fortune 500, (April 27, 1987), Fortune, The Service 500, (June 8, 1987).

6. The set of laws, 39 U.S.C. 601-606, and 18 U.S.C. 1693-1699, 1724, is known collectively as the Private Express Statutes.

7. For example, about 15 percent of Wall Street Journal subscribers receive copies outside the USPS system. Sorkin Alan L., The Economics of the Postal System, Lexington Books, D.C. Heath and Company (1980).

8. U.S. Postal Service, Annual Report of the Postmaster General, 24 (1986).

9. Bureau of the Census, U.S. Statistical Abstract (1987).

10. University of Michigan, supra, at 1.

11. Moroney, Rita, History of the U.S. Postal Service 1775-1984, 30, U.S. Postal Service (1984).

12. These national accounts are in the 10 industry categories of Direct Marketing, Finance and Banking, Federal Government, Insurance, Manufacturing, Publishing, Retail Trade, Securities, Mail Order, and Utilities. U. S. Postal Service, Comprehensive Statement on Postal Operations, 28 (1986)

13. U.S. Postal Service, Annual Report of the Postmaster General, 9 (1986).

14. 14.39 USC, 101.

15. 15.47 USC, 1.

16. In this table (for 1986), the telephone service industry is compared with the USPS. Excluded, therefore, are other postal carriers such as the parcel and other competitive carriers of hard copy material.

17. Postal Service background papers on these statutes are contained in the report The Private Express Statutes and their Administration, a June 29, 1973 report to reevaluate these statutes as required by Section 7 of the 1970 Postal Reorganization Act. In addition, a good summary of the history and implication of the Private Express Statutes is contained in the American Enterprise Institute report by John Haldi, Postal Monopoly, An Assessment of the Private Express Statutes (1974), and the report by J.I. Campbell Jr., A Practical Guide to the United States Postal Monopoly (1978), 411 East Capitol Street, S.E., Washington, D.C. 20003.

18. The desirability and extent of competition with the USPS has been debated for over a hundred years. While evaluating the effect of the Postal Reorganization Act of 1970, a Congressional report stated:

> "Many of the standard features of the present postal systems were invented by competitors during the 1840's and 1850's. Private express companies pioneered the adhesive postage stamp, the street-corner collection box, and the predecessor of special delivery service. It seems likely that revival of postal competition would produce modern-day innovations of similar magnitude."

Committee on Post Office and Civil Service, The Necessity for Change, House of Representatives, 28, Print No. 94-26, (December 10, 1976).

19. U.S. Postal Service, Competitors and Competition of the U.S. Postal Service, Volume XVIII, (June 1986).

20. The Postal Service has always been subject to competition in the Fourth Class package service.

21. Including about 7,000 private firms that deliver over 35 billion pieces of direct-marketing type mail. Direct Marketing Association, Fact Book on Direct Marketing.

22. Federal Express, for example, offers shipment control from pick-up to delivery, special containers, unique pricing, and tracing services.

23. Over 16 million Social Security benefit payments are deposited electronically each month, with over 43 percent of recipients now participating.

24. In 1968, the USPS combined heavier First Class mail (over 12 ounces) and Air Parcel Post into a new category called Priority mail.

25. U.S. Postal Service, Comprehensive Statement on Postal Operations, 32 (1986).

26. DHL and Federal Express now have significant access to foreign mailstreams.

27. ECOM was sold to former Postal Service managers.

28. Some are concerned that the 1971 reorganization, with the service remaining a Government enterprise, but run as a business, is doomed to failure. Meyers, Robert J., The Coming Collapse of the Post Office, Prentice-Hall, Inc. (1975).

29. Private organizations, such as the telephone industry, have successfully coped with the same problems of communication privacy.

30. Efficient business operation was a major emphasis of the "New Postal Service" initiative introduced in June 1986. U.S. Postal Service, Comprehensive Statement of Postal Operations, 33 (1986).

31. PL 91-375 (84 Stat. 719), Postal Reorganization Act of 1970.

32. Tierney, John T., Postal Reorganization, Auburn House Publishing Co. (1981).

33. See Appendix F of the United States Postal Service report, The Private Express Statutes and their Administration, June 29, 1973, prepared pursuant to Section 7 or the 1970 Postal Reorganization Act.

34. The history of mail service is contained in A Short History of the Mail Service, by Carl H. Scheele, Smithsonian Institution Press, (1970), The American Mail, by Wayne E. Fuller, University of Chicago Press, 1972, and History of the U.S. Postal Service 1775-1984, by Rita Moroney, U.S. Postal Service, (1984).

35. Kappel, Frederick R., Towards Postal Excellence, Commission, GPO, (June 1968).

36. Bureau of the Census, U.S. Statistical Abstract (1987).

37. U.S. Postal Service, Comprehensive Statement on Postal Operations, 3,4 (1986).

38. CEBEMA, The Computer, Business Equipment, Software, and Telecommunications Industry 1960-1995, 110 (1986).

39. An excellent discussion of Postal Service issues since reorganization, and largely today, is contained in the Postal Service Staff Study of December 1976 titled The Necessity For Change, published by the House of Representatives Committee on Post Office and Civil Service.

40. The 1986 appropriation of $748 million was reduced to $716 million because of a sequestration order under the Gramm-Rudman-Hollings Balanced Budget and Emergency Deficit Control Act of 1985. U.S. Postal Service, Comprehensive Statement on Postal Operations, 51 (1986).

41. The Congressional appropriation for the 750,000-person Postal Service is smaller than that for the 5,000-person Small Business Administration. Bureau of the Census, Statistical Abstract of the United States (1987).

42. 39 USC, Section 101(a).

43. In a memo of May 15, 1987, the Federal Trade Commission Chairman Daniel Oliver called on Postmaster General Tisch to end the postal monopoly.

44. University of Michigan, Household Mailstream Study, Final Report (1978).

45. Considering the average monthly basic telephone charge, and the average number of calls per household.

46. Rovan, Dave, "Telephone companies, after several years of higher rates, may be entering period of rate reductions," Communications Week 30 (August 24, 1987).

47. Fourth Class parcel service has changed significantly with the changing needs of the small farm community and the emergence of other viable package services. Consideration should be given to the USPS contracting out the remaining package service (602 million items for the USPS compared to over 2 billion items for UPS alone) for other means of delivery or pickup.

IX

Information Services

by Fredrick Matos

The merging of the telecommunications and computer industries over the past two decades together with a generally favorable deregulatory climate and a dynamic marketplace have been the major forces moving America into the information age. Information has been identified as a key to the nation's productivity, and it is therefore vitally important that the nation's vast amounts of information be made readily available to America's industries and populace. Only in this way can the nation maintain its industrial vitality and competitive position in the world marketplace.

This study addresses these information services that are delivered via telecommunication networks. The study relies heavily on the recent NTIA study, NTIA Information Services Report, that is a comprehensive study of the services available here and abroad, and related legal, regulatory, and policy matters.[1]

Key Industry Statistics

This review of information services available in the United States addresses both business and mass market aspects and emphasizes videotex and business information services, although there is some inevitable overlap with some information services attractive to both businesses and the mass market.

The state of information services in the United States today, particularly services delivered to home users, is largely a function of the numbers and sophistication of personal computers, which are used as information services terminals in homes and businesses.

For the purposes of this review, three distinct market segments have been identified:

1. large and medium size business users;
2. households and small businesses with personal computers, modems, and communications software; and
3. ordinary small business and home telephone subscribers.

The mass market consists of the third category.

Types of Information Services

Information services available via the public telephone networks can be generally categorized into seven different types, some of which can be further subcategorized into 222 business and consumer applications. The distinctions among the definitions are not always precise, for there is some overlap among categories, e.g., some database retrieval and messaging systems are available via consumer videotex firms.[2]

The dependence upon public-switched telephone networks of these services, and the costs which they place on such networks, also differ. Credit card verification services, for instance, typically handle many communications, but each message is of very short duration. In contrast, remote access data processing may involve fewer messages, but each message may be of some hours' duration.

Consumer Videotex. These consumer and residential services are relatively easy-to-use, low-cost services allowing residential users to store and retrieve information or perform transactions electronically. They frequently provide access to the other information services described below. Examples of videotex vendors are CompuServe and GEnie. Businesses may also make use of such services.[3]

Access/Retrieval Services. These services provide on-line information on compilations, Government documents, bibliographic information, financial data, and more. Typical users are libraries, researchers, banks, and stock brokers. The information vendors include database/retrieval services such as LEXIS, DIALOG, and public announcement services.

Messaging Services. These services permit users to address, dispatch, temporarily store, and retrieve information. Storage may be incidental to delivery and may not be the principal function of the service. Examples include electronic mail, voice storage and retrieval, and opinion polling.

Transactions. These services authorize or perform settlements for transactions such as credit card purchases, bank withdrawals, and shop-by-phone.

Personal/Environmental Management. These services monitor, measure, diagnose, and control the users' information, equipment, entertainment, or environment. Home telemetering alarm service is one example.

Computing Services. These services enable the customer to use the computing and storage power of the remote computer via timesharing. For example, businesses having large inventories often use such services.

Code and Protocol Conversion. These services are low-level network support systems required by many other information services. Examples are the code and protocol services provided by value-added networks such as Telenet and TYMNET. These services enable incompatible computers and terminals to "communicate" and operate interdependently.

Online databases and interactive services have experienced significant growth in the 1980s in both the business and mass market sectors. The Cuadra/Elsevier Directory of Online Databases, for example, indicates that 3,369 databases are available via 528 online services in 1987 compared to 400 data bases and 59 online services in 1979-80.[4] The growth is largely attributed to decreasing costs for computer hardware and increased computer literacy and awareness. The rapid growth in the number of online searches of databases over the past decade is illustrative: from less than 2 million searches in 1974 to 18 million in 1985.

Information Vendors, Information Providerts, and Gateways

A distinction has evolved in the United States between what, for purposes of this review, are called information vendors and information providers. Information vendors are firms such as DIALOG, The Source, and Compuserve, that for the most part, are retailers of information that is developed by other firms, normally referred to as information providers. Information providers or sources are firms that develop the information, update it, and store it, making it available through vendors. The situation can be viewed as a typical wholesale and retail arrangement. Examples of information providers whose information is available through one or more vendors are the Official Airline Guide, Associated Press, Dun's Marketing Services (Dun and Bradstreet), and McGraw-Hill News.

A few firms are both information vendors and information providers, but these are the exception rather than the rule. Typical examples are Dow Jones News/Retrieval, which provides its own financial information plus information from other sources such as The Washington Post and Standard and Poor's Online; and Mead Data Central, which offers its own legal information service, LEXIS, and provides other information such as news from The Washington Post, Associated Press, and TASS.

In the context of the information services business, the term "gateway" has a unique definition: a gateway is a service permitting users to access various information sources offered by other vendors by initially accessing only a single vendor. The first vendor, for all practical purposes, provides a transparency to the user. The information vendor CompuServe, for example, provides access to five other information vendors that make many information sources and databases available. Most recently, the term has been used to describe certain of the services that may now be provided by the Bell companies under the AT&T consent decree.[5]

Consumer Videotex

Videotex is the information service that many experts consider most likely to be used by the mass market consumer. It is a type of electronic information service that was developed in the 1970s and which began to grow as an industry in the early 1980s. As a two-way medium, videotex permits users to conduct transactions, send and receive non-entertainment electronic messages, and gain access to a wide range of information services.

In the United States, videotex has become popular with many business users as well as a substantial number of computer enthusiasts, particularly middle and upper-income level customers. A recent FCC proceeding on imposing access charges on enhanced services providers generated nearly 500 formal and informal comments and well over 5,000 letters, many of which were from mass market consumers, opposing the charges.[6]

More than two dozen commercial videotex systems are in operation in the United States. The General Interest Services section of TABLE 1 identifies the major retailers of consumer videotex services such as CompuServe, GEnie, The Source, and Delphi. These firms largely provide access to a number of information sources and databases maintained by others.[7]

The total number of U.S. subscribers to mass market videotex was approximately 720,000 in 1986, and slightly over one million in 1987, with 1987 revenues of $114.8 million.[89]

Although notable, the revenues of these services and their customer bases should be viewed in the context of a U.S. telecommunications industry that in 1987 should have service revenues exceeding $127 billion, and will serve about 83 million

TABLE 1

INFORMATION INDUSTRY BULLETIN [illegible] ONLINE INDEX

[illegible]	Company	Service	[illegible]	[illegible]	Change
	GENERAL INTEREST SERVICES				
[illegible]	CompuServe	CompuServe Info Service	[illegible]	[illegible]	[illegible]
[illegible]	British Telecom/Dialcom	Dialcom	[illegible]	[illegible]	[illegible]
[illegible]	Western Union	EasyLink	[illegible]	[illegible]	[illegible]
[illegible]	GEISCO	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Source Telecomputing	The Source (1)	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	SUBTOTAL		[illegible]	[illegible]	[illegible]
	FINANCIAL SERVICES				
[illegible]	Dow Jones	Dow Jones News/Retrieval (1)	[illegible]	[illegible]	[illegible]
[illegible]	Reuters	Monitor	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	Financial Info Services	[illegible]	[illegible]	[illegible]
[illegible]	ADP/Bunker Ramo	Financial Info Service	[illegible]	[illegible]	[illegible]
[illegible]	Telerate	Telerate	[illegible]	[illegible]	[illegible]
[illegible]	Knight Ridder	K-R Financial Information (2)	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	SUBTOTAL		[illegible]	[illegible]	[illegible]
	SCI/TECH/PROFESSIONAL SERVICES				
[illegible]	Mead Data Central	LEXIS NEXIS MEDIS	[illegible]	[illegible]	[illegible]
[illegible]	Dialog Info Services	Dialog	[illegible]	[illegible]	[illegible]
[illegible]	BRS	BRS	[illegible]	[illegible]	[illegible]
[illegible]	PRC Realty	Multiple Listing Service	[illegible]	[illegible]	[illegible]
[illegible]	OCLC Inc.	OCLC	[illegible]	[illegible]	[illegible]
[illegible]	Info Globe	Info Globe	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	I.P. Sharp Online (1)	[illegible]	[illegible]	[illegible]
[illegible]	Knight-Ridder	VU/TEXT	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	Data [illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	SUBTOTAL		[illegible]	[illegible]	[illegible]
	CREDIT REPORTING				
[illegible]	TRW	Credit Data Service	[illegible]	[illegible]	[illegible]
[illegible]	Dun & Bradstreet	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Equifax	Financial Control Service	[illegible]	[illegible]	[illegible]
[illegible]	Chilton	Chilton Credit Reporting (1)	[illegible]	[illegible]	[illegible]
	SUBTOTAL		[illegible]	[illegible]	[illegible]
	NEWS SERVICES				
[illegible]	NewsNet	NewsNet	[illegible]	[illegible]	[illegible]
[illegible]	United Press Int'l	UPI (1)	[illegible]	[illegible]	[illegible]
[illegible]	Business Wire	Business Wire	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	SUBTOTAL		[illegible]	[illegible]	[illegible]
	AIRLINE INFORMATION & RESERVATION SERVICES				
[illegible]	American Airlines	SABRE	[illegible]	[illegible]	[illegible]
[illegible]	United Airlines	Apollo	[illegible]	[illegible]	[illegible]
[illegible]	Official Airline Guides	OAG Electronic Edition	[illegible]	[illegible]	[illegible]
[illegible]	Texas Air	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	TWA/Northwest Airlines	PARS	[illegible]	[illegible]	[illegible]
[illegible]	Delta	[illegible]	[illegible]	[illegible]	[illegible]
	SUBTOTAL		[illegible]	[illegible]	[illegible]
	TOTAL		[illegible]	[illegible]	[illegible]

(1) [illegible]

(2) Knight Ridder [illegible]

Note: [illegible]

[illegible]

American households. Electronic online information services, in short, currently serve only a statistically insignificant percentage of U.S. families. Indeed, total U.S. information subscribers of one million number less than half the current subscribers to France Telecom's Teletel service, despite the fact that there are about five times as many U.S. telephone access lines as in France.

The following discussion reviews some of the significant residential market information vendors.

CompuServe. CompuServe is owned by H&R Block and is the largest mass market information services firm in the United States, offering over 400 products and services. The firm originated in the 1970s as a computer time sharing company, and the business generally evolved into information services. The firm had 416,000 subscribers as of March 1, 1988, and is adding five to seven thousand new subscribers per month.

CompuServe had 1987 revenues of $37.2 million for consumer information service; $16 million for network services; and $44 million for business information services.[10]

CompuServe states that the system can be accessed by either a simple information services terminal that does not have processing capability, or by more sophisticated personal computers. CompuServe can be accessed in over 500 cities with a modem, communications software, and a local telephone call, and it is available in 74 countries. CompuServe has its own value-added packet switching communications network serving about 1300 nodes.[11]

CompuServe maintains some of its own databases, but the major usage is for information supplied by outside providers. The firm has experienced significant growth in the number of monthly "dialups" and minutes-of-use since its inception in June 1982. The usage data is presented in TABLE 2.

CompuServe conducted a survey of its subscribers and found that 96 percent of its customers use personal computers at home and 75 percent use them at work. Furthermore, the typical user is 37.7 years old with an average annual household income of $56,000. The survey found that 94 percent of the users were male and 64 percent were college graduates.

GEnie. GEnie is operated by GE Information Services (formerly GEISCO) and has been in business since October, 1985, during which time the number of subscribers grew from zero to 100,000 as of May, 1988. The information services business originated from the General Electric computer services time-sharing business. GEnie is adding five to ten thousand new subscribers per month and projects 188,000 subscribers at the end of 1988. Usage is 95 percent home consumer, with the most popular information source being the Apple Macintosh bulletin board, followed by the IBM Personal Computer user bulletin board. Overall, GEnie has on the order of 120 different information products available. The firm reports that a simple information services terminal can access the system, as will low end computers such as the Commodore 64 and Texas Instruments TI-99/IV, and more sophisticated

TABLE 2
COMPUSERVE TOTAL USAGE[12]
(Per Month)

Mo./Year	Number of Dialups	Minutes of Use
June 1982	595	9,100,000
June 1983	1005	14,373,000
June 1984	2000	21,307,000
June 1985	3170	29,509,000
June 1986	5237	31,818,000
June 1987	6860	38,408,000

personal computers. GEnie does not maintain its own databases, but rather provides the services of others. It passes on 10-20 percent of its user fee to the information provider.[13]

The Source. The Source was originally established by several entrepreneurs in 1980, a majority interest was later purchased by Readers Digest in 1982, and it is now operated by Welsh, Carson, Anderson, and Stowe. Its customer base of 70,000 is divided 60:40 between business and home usage, respectively. Electronic messaging is the most popular service, followed by investment information. The Source reports that it has "hundreds of services," including some services such as UPI News that themselves have many different services available. The firm has 30-40 external information providers and about 10 internal information services. A simple information services terminal can access the system, as will more sophisticated personal computers. The subscriber base is growing at an annual rate of about 20 percent. Nine to 15 percent of the user fee is normally passed on to the information provider, although the rate may differ substantially for more costly information such as stock brokerage research reports.[14]

Prodigy. With operations begun in the summer of 1988, the Prodigy Services Co., formerly known as Trintex, is expected to be a major force in information services. The firm is jointly owned by IBM and Sears, which reportedly invested over $250 million into the effort. "Prodigy" is described as an interactive personal information service.[15]

Prodigy opened its initial markets in the San Francisco, Atlanta, and Hartford areas, and it plans to have a nationwide system operating within three years. Over 240 databases and information services will be available along with 30 "expert services" -- unique dialogue services with experts on various subjects such as politics or sports. Prodigy will have its own data bases in addition to outside data and information sources.[16]

Prodigy will require the consumer to have a computer with capabilities equivalent to at least an IBM or Apple personal computer with a memory of 512 kilobytes and appropriate graphics, with color graphics preferred. Rather than having a price based on usage, the Prodigy service will be sold at a flat monthly rate, with the initial price expected to be on the order of $9.95.[17]

QuantumLink. QuantumLink is operated by Quantum Computer Services, Inc. of Vienna, Virginia, a firm founded in May, 1985. It is an independent firm with financial backing from the venture capital subsidiaries of firms such as Citicorp, Allstate Insurance, and Hambrecht and Quist. The number of users has been published as 20,000 at the end of 1986.[18]

Quantum claims to be the second largest consumer-oriented videotex service in the United States, generating as of September, 1987, 15 million minutes of access time per month. The QuantumLink service is identified by the firm as the "Official On-Line Service" for Commodore computer users. The service became available to Apple computer users in June, 1988 under an arrangement to provide the "AppleLink" service.[19]

QuantumLink provides home computer users with a wide variety of educational, and informational material, including educational tutorials; adult education programs; entertainment and news; electronic mail; shopping; reservation services; and interactive forums for the disabled and other special interest groups.[20]

QuantumLink is only available from 6:00 p.m. to 7:00 a.m. Eastern time. The firm found that telecommunications rates are much higher during other hours, and the expected usage during normal business hours would be insufficient to overcome or otherwise significantly defray the higher telecommunications costs.[21]

Boston CitiNet. Boston CitiNet, operated by Applied Videotex Systems, is a free online information service available to anyone with a computer and a modem. The CitiNet is advertiser-supported and provides services such as electronic mail (at a $50 annual charge); real estate information; art and entertainment listings; sports and ski reports; "chat services" (at a slight charge); shopping; business news; education; employment information; and medical and travel information, totaling about 4,000 menu choices.[22]

The user profile statistics for CitiNet indicate that 60 percent are college graduates with 31 percent having master's or doctor's degrees; 51 percent of the users are professionals; 84 percent are male; and 59 percent have incomes between $35,000 and $75,000. The usage pattern indicates that 18 percent use CitiNet several times per week, 29 percent once per week, and 32 percent less than once per week.[23]

Boston CitiNet is selling franchise rights to its software. Rights have been sold at prices that began at $55,000 and have risen to $130,000 plus 2.5 percent of the gross revenue; or $500,000 plus one-half of the net profits.[24]

Applied Videotex Systems entered into various arrangements with NYNEX and its subsidiary, New England Telephone, in 1987 as part of the NYNEX planning and research activities into data network development. NYNEX sponsored a seminar in late May, 1987 at Applied Video Systems where NYNEX reportedly presented its plans to serve as the central gateway to information providers.[illegible]

More recently, Boston CitiNet has been conducting an online questionnaire survey by NYNEX and New England Telephone. The survey asks about the users' interests in gateway packages and their current usage patterns for various information services.[illegible]

Cleveland Free-Net. Cleveland Free-Net began in 1984 as a method to exchange messages among five clinical units of the Case Western Reserve University medical complex. Public access to the system was obtained soon afterwards via "leaks" of the bulletin board access telephone number to the general public. By way of messages sent by the general public, it was soon learned that the public had many questions concerning health and medicine. These questions were answered via the Free-Net by qualified doctors and other medical personnel. Within six weeks, the number of questions grew to 300 per week.

The original concept was called "St. Silicon's Hospital and Information Dispensary" and was an "electronic hospital." That was expanded to an "electronic city" with electronic mail acting as the "post office", "school house" teaching telecomputing to students; "court house" providing legal information; and "government house" providing information concerning elected officials. The "electronic hospital" was later expanded to include dental and other medical and health information. Plans are to expand to 18 or 19 "buildings" or "houses" with each having a unique information source. A chat line is being considered for the new version.

The staff consists of 1 and 1/2 full time equivalent personnel at Case Western Reserve who develop software and manage the system. The system has been funded by equipment donations from AT&T Information Systems in the form of a Model 3B2400 multi-user computer, and grants from Ohio Bell Telephone, University Hospital, and Case Western Reserve.

Free-Net management indicates that the most important element of the Free-Net is the volunteer staff, i.e. doctors, lawyers, and others that provide the expert answers to the public's questions.

Due to a shortage of resources together with a tremendous demand for information, the Cleveland Free-Net has had to limit the number of subscribers to 5,500 as of May 1988. Even at 5,500 subscribers, there is a substantial waiting time to obtain online access.

One popular application of the Free-Net has been the use of electronic mail by small businesses that cannot otherwise afford to pay the high charges for a commercial electronic mail service. A second popular application is the teaching of telecomputing to students. Future plans are to make government-created information available via the Free-Net. This would include some census data, county real estate data, and medical information.

The Cleveland Free-Net has spawned the Society for Public Access Computing (SOPAC). Cleveland Free-Net software is being made available on lease for $1 per year to communities and community organizations such as universities, hospitals, and county governments. The objective is the creation of "community computers" as information centers. As of May 1988, there were centers in 35 cities in various stages of development, with Youngstown, Akron, and Miami systems scheduled to become operational in 1988. The Miami system will be bilingual.

The Cleveland Free-Net user profile is diverse, covering a large number of users from "blue collar" parts of Cleveland in addition to the more affluent suburbs.[27]

U.S. Videotel. U.S. Videotel is an information vendor in Houston, Texas that reportedly has obtained exclusive U.S. rights to the French Minitel technology. Videotel has imported a number of French Minitel terminals and plans to develop an information business using them as the foundation. The terminals will be named "Videotels" in the United States. Personal computers will also be able to access the Videotel information system.[28]

According to a publication dated March, 1988, Videotel has approximately three dozen services available, including the Official Airline Guide, American Airlines schedules, USA TODAY news stories, and the Comp-U-Card shopping service.[29] Home banking is also being planned.[30]

U.S. Videotel plans to be in operation in 1988. The firm reports holding joint marketing discussions with several of the Bell companies.[31]

Bulletin Boards. Computer bulletin boards are easily established and enable groups of people to share information with each other. Examples are IBM Personal Computer or Apple computer user groups established in communities throughout the United States. Companies and government agencies can also establish bulletin boards to communicate via electronic mail. Although the number of bulletin boards is difficult to estimate accurately, they number into the tens of thousands. Telenet, for example, has indicated that there are 30,000 bulletin boards accessible to the public via a dial-up telephone line, a personal computer, and a modem.[32]

Consumer Videotex Prices

TABLE 3 presents the prices of some of the widely used mass market information service vendors in the United States. Discounts are occasionally offered on the initial registration fees. Additional fees are commonly imposed on the retrieval of some information (e.g., access to an encyclopedia through CompuServe requires an additional monthly fee of $7.50), and accessing specialized financial information often requires additional charges.

Business Information Services

The technology and distribution systems for mass market information services are frequently initially developed and deployed for business use. This report will therefore describe today's business-oriented information services, some of which have already become available and used in the consumer market.

TABLE 3
Pricing Information

			Prime Time Rate (Per Hour)		Non-Prime Time Rate (Per Hour)	
Vendor	Registration Fee	Monthly Minimum	300 Baud[a]	1200 Baud	300 Baud	1200 Baud
CompuServe	$39.39	None	$ 6.00	$12.50	$ 6.00	$12.50
Dialcom	25.00	$25.00	19.00	19.00	10.50	10.50
EasyLink	None	25.00	21.00	30.00	12.60	18.00
GEnie	29.95	None	35.00	35.00	5.00	5.00
The Source	29.95	10.00	21.60	25.80	8.40	10.80
Delphi (Local)	49.95	None	9.60	9.60	6.60	6.60
Delphi (L.Dist)	49.95	None	17.40	17.40	7.20	7.20
QuantumLink	None	9.95	Service not available		4.80	4.80
Prodigy	None	9.95 Flat Rate	None	None	None	None
People/Link	15.00	None	11.95	12.95	4.95	4.95
PC Pursuit (Telenet)	25.00	25.00	10.50	10.50	Covered in $25 monthly	

[a] Baud A baud is the basic unit of modulation rate or signalling speed. One baud corresponds to a rate of one unit interval per second, where the modulation rate is expressed as the reciprocal of the duration, in seconds, of the smallest unit interval.

The size of the U.S. business information market is currently about $5 billion with a forecast of $15 billion for 1992.[33] Business usage of information services is primarily for financial, legal, journalistic, library, credit reporting, airline and travel information, and electronic mail purposes. In many cases, businesses make use of an information service provider indirectly through a third party, such as a travel agent or stock broker. The public telephone network and the available businesses providing access to information services in the United States also make it very convenient for consumers to simply call such a third party agent to obtain the information, rather than access the information themselves. Furthermore, there is also widespread use of the toll-free "800" service to obtain various information, whether from airlines, car rental companies, hotels and motels, catalogue shopping, etc.

Table 1 presents some of the major business information service vendors. An accurate count of the total number of subscribers is difficult to obtain because of multiple subscribership. An accurate estimate of third party or indirect consumer access to such information sources (such as the number of people calling toll-free "800" numbers to make travel reservations) is also difficult to develop.

There are several information vendors in the United States that provide access to a number of information databases, the largest of which are Dow Jones News/Retrieval; Mead Data Central; NewsNet; ORBIT; Data-Times; and DIALOG. Such vendors would typically be used by public libraries and information resource departments of private companies, government agencies, and law firms.

More specialized information vendors are the airline information and reservation services such as SABRE/American Airlines and Apollo/United Airlines.

The vendor-provider relationship can take several forms. The information vendor may have an exclusive contract with an information provider so that the provider does not make its database available to anyone except that vendor. The non-exclusive relationship, in contrast, permits the database provider to make information available through a number of vendors.

Online business information services have experienced a robust growth. One indication is that there were 3010 publicly available data bases in 1985 (projected at 4000 in 1988), compared to 301 in 1975. Furthermore, the 1975 figure includes only word-oriented databases, as the numeric, modelling, image, and transaction types of databases had not yet come into the marketplace. Thus the number of databases doubled between 1975 and 1981 and quintupled between 1981 and 1985. The records contained in the databases grew from 52 million in 1975 to 1.68 billion in 1985, a 32-fold increase.[34]

Several trade associations exist for the business online information services industry; a number of scholarly research and applications oriented journals are published; and trade shows are held several times per year in the United States, attracting 3,000-4,000 attendees at each show where new products and services are the main attraction. Another measure of the health of the industry is the rapid growth and interest of trade associations. The Information Industries Association, for example, has over 700 members in mid-1988, a large increase over the 300 members in 1984. These activities, together with the growth evidenced by the statistics previously presented, indicate that the trend of the business information services sector in the United States is one of rapid growth in the near future.

Examples of Online Business Information Services

The following examples of business services were selected as typical services to develop an understanding of the status of online business information services.

DIALOG. DIALOG is a subsidiary of the Lockheed Corporation and has been in operation since 1972, beginning as a service for NASA. DIALOG bills itself as the "World's Largest Online Knowledgebank." The firm has over 300 databases, providing access to over 100 million items such as summaries of articles and reports, detailed financial data, directory listings of companies, statistics and data on various topics, full-text articles, and newswires. Its main clients are public libraries, information centers and libraries of private companies, hospitals, universities, and government agencies, law firms, and to a lesser extent, private individuals.

Table 1 presents statistics on the number of subscribers to DIALOG -- 70,000 on January 1, 1987 and 86,000 on January 1, 1988, a growth of 22.9 percent. There is no easy method to determine the number of "secondary" users of DIALOG, e.g., the number of users accessing the service via public libraries.

The online connect rates for DIALOG depend on the type of service accessed, ranging from $0.25 to $5.00 per minute, with most services falling into the $1.00-2.00 per minute range. There are additional charges for offline printing for full records and for other services involving full records. DIALOG employs the TYMNET, TELENET, and DIALNET packet data networks, with local telephone call accessability in most cities of the United States. DIALOG can be accessed with virtually any personal computer equipped with a modem and associated software.

Mead Data Central. As indicated in TABLE 1, Mead Data Central has 205,000 subscribers and provides a range of information services via its LEXIS, NEXIS, LEXPAT, MEDIS, EXCHANGE, and ECLIPSE services. With 32 million articles, Mead claims to be the world's largest resource of full-text information. Information is provided on news and business, politics and government, finance, accounting and securities, science and technology, medicine, and legal information.[iiv]

Its major clients include law firms, public libraries, and information centers and libraries of private companies and government agencies.

The LEXIS legal information service was initiated in 1972, and the firm was acquired by the Mead Corporation, a paper company, in 1976. For its information services subsidiary, Mead reported revenues of $187.6 million for 1986, with NEXIS and LEXIS accesses numbering about 620,000. Revenues grew to $231.2 million in 1987. Profits for the subsidiary are not disclosed by the parent corporation.

Dow Jones News/Retrieval. The Dow Jones News/Retrieval service is the largest financial information services firm, with 285,000 subscribers. The firm is both an information vendor, for services developed and maintained by information provider firms such as Dun and Bradstreet, and it is an information provider maintaining some of its own data bases such as The Wall Street Journal (full text version).

SABRE. SABRE is a airline and travel information services firm operated by American Airlines. The number of subscribers on January 1, 1988 was 62,900 and SABRE claims to have about a 37 percent share of the market. Terminals are located in 15,000 travel agencies; 62,000 are at airline terminals; and 15,000 are used by American Airlines. The firm estimates its peak day usage at 57,000,000 messages. The host computers store 35,000,000 different worldwide airfares, information on 16,000 hotel properties and the worldwide operations of 35 rental car companies.

The host computers are six IBM model 3090s operated in tandem. SABRE employs leased telephone lines for its own telecommunications network.

American Airlines also provides a limited version of SABRE called EasySABRE to the residential and small business market.

CompuServe. CompuServe obtains $80 million of its $130 million annual revenues (latest 12 months) from its business information services. The firm reports that this segment is growing at an annual rate of 25 percent. Of the $80 million, $25 million is attributed to the revenues of its value-added communications network and $55 million from its information services.[37]

The firm provides computer communications services; information delivery and database services; demographic databases, database management services, news retrieval services, and value-added services.[38]

CompuServe provides services to the Department of Health and Human Services; Department of Interior; and the Department of Commerce. Electronic mail is the most widely used service by the government agencies.

CompuServe also serves as an interface between U.S. exporters and the Department of Commerce's Office of Export Licensing. Exporters can apply for licenses electronically thereby saving substantial time over the "paper" method. The service is called "ELAIN" (Export License and Application and Information Network).[39]

Electronic Mail Several information service vendors specialize in electronic mail. For example, Easylink is owned by Western Union and has 175,000 "mailboxes." Each mailbox may be used by a large number of users sending messages to each other. The largest publicly available electronic mail providers include Dialcom (owned by British Telecom), EasyPlex (CompuServe), Quik-Com (General Electric), On Tyme (McDonnell Douglas), MCI Mail, The Source, Telemail (US Sprint) and Easylink (Western Union). Easylink is the most widely used electronic mail service, with the main users being medium and large corporations. With 175,000 mailboxes, Easylink transmits over 9,000,000 messages per month.

Not included in the electronic mail statistics is the electronic mail that is privately operated by large corporations such as General Motors and CitiBank.

The market for electronic messaging services has grown phenomenally since 1980, after the FCC confirmed the unregulated status of enhanced services in the Second Computer Inquiry. The number of in-house electronic messaging users reached 5.6 million users in 1987, an increase of about 40 percent over 1986. The number of subscribers to publicly available electronic messaging services has grown on the average of 20 percent over the last five years, and reached about 1.3 million users at the end of 1987. When considering both private and public electronic mailboxes, the total number of electronic messages transmitted in 1987 averaged about 62.9 million per month, of which 21 million are attributed to the public mailboxes. By way of comparison, long distance telephone calls total about 100 million daily, and the U.S. Postal Service volume totals about 130 million pieces of mail daily. Thus, electronic mailbox usage today constitutes only a very small fraction of the overall U.S. message volume.

Typical prices for electronic mail from publicly available services range from $6 to $15 per hour for daytime usage and as low as $4 per hour for evening and weekend usage.

Consumer Videotex Terminals

Personal Computers as Terminals. TABLE 4 presents data on the number of personal computers shipped to the home market in the past and projected through 1990. The LINK Resources estimates based on consumer surveys on personal computers are presented in TABLE 5.[40]

TABLE 4
Personal Computer Data[41]
* Estimated

Year	Units (x1000)	Cumulative Units (x1000)
1981	149	149
1982	1,748	1,897
1983	3,355	5,252
1984	3,430	8,682
1985	2,190	10,872
1986	2,290	13,162
1987	2,050*	15,212*
1988	2,010*	17,222*
1989	1,979*	19,197*
1990	1,910*	21,107*

TABLE 5
Forecasts for Perconal Computers in U.S. Households

Year	Units Shipped (000)	Active IB (000)	US HH (000)	HH with PCs (000)	% of HH Penetrated
1987	4,228	20,563	90,200	17,684	19.6
1988	4,482	24,645	91,600	20,209	22.1
1989	4,661	29,006	93,000	22,625	24.3
1990	4,848	33,554	94,300	25,165	26.7
1991	5,090	38,344	95,700	26,841	28.0
1992	5,344	43,488	96,900	29,137	30.1

(Abbreviations: IB = Installed Base, HH = Households)

Source: LINK REsources Corporation, 1988

LINK develops its statistics on the numbers of households with personal computers via statistical surveys of a sampling of 4,000 households. The U.S. Industrial Outlook data is based on shipments of computers manufactured in the United States.

Although there is about a 4 million difference in the 1990 cumulative households-with-personal-computers figures between the two future projections, there is closer agreement on the percentage growth expected in the 1990-92 timeframe. The U.S. Industrial Outlook projects about a 60 percent increase from 1987 to 1990, and LINK Resources projects about a 40 percent increase.

Personal computer use at home is growing rapidly, due to decreased costs, improved ease of use, and more widespread "computer literacy." One trade association estimates that 20 percent of the 90 million households in the United States have at least one home computer -- indicating that perhaps as many as 18 million households have at least one home computer.[42]

LINK forecasts that PCs are expected to reach 24.3 percent penetration in 1989, and 30.1 percent by 1992. Modem penetration is expected to break the 20 percent barrier in 1991, and reach 23.9 percent by 1992.[43]

A videotex industry association has proposed a "vision" for the industry by the year 2000:[44]

- 97 percent of the North American population will have access to videotex.
- 50 percent of North American population will actually be using videotex on an occasional basis.

TABLE 6 presents data on the numbers of modems in U.S. households forecasting the numbers of households having the capability of accessing information sources.[45] (A modem is a device used to interconnect a computer with the telephone network. Modems cost $100 and higher, and additional communications software is required at a typical cost of $75 and up.)

The future may see the development of the end-user terminal go in several ways: it may become simpler, evolving towards the simple French Minitel terminal without processing capabilities and with self-contained modems; or it may grow in sophistication such as the terminals that will be required for the new IBM/Sears Prodigy information services -- with substantial computer memory, software, and color graphics preferred to access the information. A more likely result is a blend of terminals in the mass market ranging from simple, low-cost types to higher level personal computers.

The disadvantage of the low-cost or "dumb" terminals is their lack of processing capability. This prevents the user from "downloading" the information into his terminal and processing it at his convenience. The low-end user must stay connected online to the information source thus running up online usage charges, whereas the user with a personal computer can retrieve ("download") the nformation quickly, store it, and process it later.

TABLE 6
Modem Penetration in the United States

Year	US HH (000)	PC IB (000)	% PCs with Modems	Modem IB (000)	% of HH Penetrated
1987	90,200	20,563	29.2	5,996	6.6
1988	91,600	24,645	35.2	8,677	9.5
1989	93,000	29,006	40.6	11,773	12.7
1990	94,300	33,554	46.8	15,698	16.6
1991	95,700	38,344	50.9	19,527	23.9
1992	96,900	43,488	53.4	23,203	23.9

(Abbreviations: IB = Installed Base, HH = Households)
Source: LINK Resources Corporation, 1988

Videotex-Only Terminals. Households with ordinary telephones are the largest untapped market for consumer videotex. Many of these households may in the future purchase computer terminals, but even if they do not, they may accept a low-cost easy-to-use information services terminal. Design variations of the terminal models may also enable them to be used as telephones.

Although they have not been mass marketed, there are videotex terminals available in the United States manufactured and sold by AT&T Information Services, Cardinal Technologies, Northern Telecom, and DigiTel, Inc. A France based firm, Telic Alcatel, has indicated that it plans to manufacture Minitel-type terminals in the United States beginning in 1989.

a. AT&T. AT&T sells its Model 1310 Video Communication Terminal at a price of $249 and the Model 2300 Video Information Terminal at a price of $795.

To display information, the Models 1310 and 2300 must be connected by the user to a television receiver or a video monitor. The Model 2300 is an outgrowth of the Sceptre videotex terminal that AT&T developed for the Viewtron service (since discontinued) in Florida.[46]

b. Cardinal Technologies. Videotex terminals are manufactured and sold by Cardinal Technologies, a small firm in Lancaster, Pennsylvania that was formed via a leveraged buyout of what was formerly a division of RCA. The product line apparently was not suited to the future business plans of General Electric when it purchased RCA.

The Cardinal videotex terminal uses a standard sized keyboard and self-contained modem and communications software. An external monitor such as a TV receiver is required. The basic videotex terminal Model CP 600 costs $399 in single lots and $249 in quantities of 100 or more.

Cardinal has been in discussions and conducted market studies with several of the Bell companies to determine the market potential for the Cardinal in conjunction with information services gateways.[47]

c. Northern Telecom. Northern Telecom manufactures and sells the "Displayphone" in the United States. The Displayphone is an integrated unit that combines a telephone with a computer terminal. Priced on the order of $700, very few units have been sold.

Northern Telecom has also built a special terminal for the ALEX videotex services system that will be offered in December, 1988 in Canada by Bell Canada. The unit is self-contained with a small screen and smaller-than-standard sized keyboard, similar in size to the French Minitel terminal.

d. Digitel, Inc. Digitel, Inc. is a firm in Cambridge, Massachusetts that has developed a terminal combining a telephone and a detachable computer keyboard. The modem and communications capability are built into the telephone part of the unit.

e. Telic Alcatel. Telic Alcatel, the largest manufacturer of Minitel terminals, has indicated that it plans to manufacture an "Americanized" version of the French Minitel terminal in Corinth, Mississippi beginning in 1989. The firm also plans to establish a research and development facility in the United States to develop the "next-generation" of information services terminals.[48] (Telic Alcatel has existing plants and facilities in the United States as a result of its purchase of ITT facilities.)

Legal and Regulatory Environment for Information

Introduction

Any analysis of the legal and regulatory status of information services in the United States requires that one first define the scope of services falling within that label. Information services in the broadest sense may include information provided via conventional telecommunications networks, or by other means as well -- such as cable TV facilities or printed materials. This report does not determine whether the term "information services" should generally be defined in narrow or broad terms. The NTIA review of telecommunications trade issues filed with the AT&T consent decree court in 1987 endeavored broadly to categorize information services into three classes: those which are generally regarded as logical extensions of telephone service; those that involve access to an interaction with computer databases; and those which resemble mass media offerings. The focus here, however, is on information services which may be provided via telecommunications links, such as videotex services, as earlier defined. The reason for this focus is the existence of particular regulatory and legal issues which play a critical role in the development of such information services in this country and internationally.

The Regulatory Environment Established by the Federal Communications Commission

Information Services Are Not Regulated. Historically, the Federal Communications Commission (FCC) has promoted and maintained an unregulated environment for the offering of information services by non-common carriers, i.e., companies not subject to rate regulation under the 1934 Communications Act. Of course, offering of information services is subject to the antitrust laws as are other laws governing business ventures generally, but that is not a matter directly under the jurisdiction of the Commission.

Because regulated common carriers have also sought to offer information services, however, the FCC became involved in establishing various conditions under which carriers subject to its jurisdiction could do so. Concerns leading to the FCC's involvement included that carriers might use cross-subsidies from their rate-regulated services to benefit their competitive ventures, and that there might be discrimination in favor of their own offerings of information services with respect to network access. Additionally, some have contended that permitting regulated carriers to expand their service repertoires, or diversify into new markets, in some fashion would divert management from its assumed "primary mission," a rationale, incidentally, also advanced by the AT&T consent decree court at one point.

For more than 20 years, however, the FCC has conducted various proceedings dealing with the line between regulated basic common carrier services and unregulated offerings (encompassing information-type services), and public safeguards for the offering of such services by carriers. The FCC has initiated three different major inquiries to address regulatory issues stemming from the confluence of computer and communications functions.

The Conditions Under Which Carriers May Provide Information Services Are Governed By The FCC. Pursuant to its first inquiry, referred to as Computer I, the FCC decided on a case-by-case basis whether individual services provided by AT&T, the Bell companies, or other carriers subject to its jurisdiction were more like communications or more like data processing services.[49] While data processing-type services were not considered common carriage, and thus were free of tariff regulation and related regulatory requirements, their provision by a carrier was nonetheless subject to strict separation from the carrier's regulated (i.e., tariffed) telecommunications offerings.

Ultimately finding this case-by-case approach to be cumbersome, impractical, and not promoting more widespread development and use of information services, the FCC took a new, simpler approach in its Computer II proceeding.[50] There it decided to create a definitional scheme delineating which services were subject to tariff review and facilities authorization rules, and which could be offered on an essentially unregulated basis. The FCC resolved that services providing nothing more than information transport, without any content change would be labeled "basic" and would remain subject to the Title II regulatory scheme of the Communications Act, which sets forth tariff filing and other regulatory requirements.

A second category of services was labeled "enhanced" and defined as:

> *services offered over common carrier transmission facilities used in interstate communications, which employ computer processing applications that act on format, content, code, protocol or similar aspects of the subscriber's transmitted information; provide the subscriber additional, different or restructured information; or involve subscriber interaction with stored information.*

Those services, which this report also refers to as "information services,"[51] were found to fall outside of the FCC's direct Title II authority, but nevertheless within its "ancillary" jurisdiction over common carriage generally. The FCC concluded that any enhanced services provided by AT&T must be offered through a separate subsidiary, but it did not impose that requirement on any of the independent telephone companies. When the BOCs were later divested from AT&T, the FCC also ruled that its Computer II separate subsidiary requirements would apply to the divested Bell companies.[52]

Finally, in Computer III, the FCC confronted arguments that the separate subsidiary rules were not cost-effective, and that in some instances they prevented the offering of new services to the public.[53] The FCC recently decided to eliminate its separate subsidiary requirements and to substitute for them a regime of "non-structural" safeguards including, among other things, additional cost allocation controls and network access requirements for competitors in the form of "Comparably Efficient Interconnection" (CEI) and "Open Network Architecture" (ONA).[54]

Once the FCC approves ONA plans (filed by each Bell company and AT&T) and ONA tariffs are in place, the full set of non-structural safeguards will be established. At that point, the carriers will no longer be subject to Computer II separate subsidiary requirements. Furthermore, pending ONA implementation, the Bell companies may use CEI, in conjunction with other non-structural safeguards, to be relieved of the structural separation rules. Since ONA plans are to encompass CEI parameters, CEI is strictly an interim measure to be used while ONA is being developed. Accordingly, without FCC approval of either CEI or ONA plans, a Bell company or AT&T would remain subject to the separate subsidiary requirements for the offering of enhanced services.

CEI And ONA Are Means To Provide Greater Network Access For Information Service Providers. The purpose of CEI is to ensure that if certain regulated carriers -- namely AT&T or the Bell companies -- offer a specific information service, they make available to others the same type of network access provided for their own information service offering. ONA is a more long range and non-service specific plan to foster the growth of the enhanced or information services industry. It requires the Bell companies to unbundle their basic network service offerings and make the underlying basic service elements available to their information service competitors on a tariffed basis. AT&T is subject to somewhat less stringent requirements than the Bell companies in this regard, but is also required to provide ONA.

To date, a few CEI plans have been approved by the FCC.[55] ONA plans have been filed, and a public comment process is underway. It cannot be determined at this point when ONA plans will be in place. The ONA plans are creating controversy in the industry, however, as the Bell companies and their potential competitors explore the appropriate parameters for carrying out the FCC's ONA policy.

NTIA recently participated in the Commission's ONA proceedings, contending that the Bell companies' initial ONA plans were not acceptable as filed. NTIA set forth a set of principles which it urged the FCC to adopt, in order to guide the ONA process and to create greater certainty about the Bell companies' obligations. These principles reflected various concerns including, for example, suggesting that some degree of national uniformity for technical standards is needed to foster information services growth.[56] A key part of the NTIA proposal was the recommendation for formation of a neutral inter-industry entity to deal with certain issues more appropriate for the industry than the Commission to resolve. Finally, NTIA urged that those involved in ONA recognize it is not a one-step process, but a complex concept which must be implemented in stages, and subject to modification over time to accommodate technological developments.[57]

The FCC Has Exempted Information Service Providers From Payment Of Access Charges. Access charges have recently become a significant issue for the information service industry, focusing primarily on the FCC's proposal to end that industry's exemption from payment of such charges.[58] These are usage-sensitive charges (ultimately paid by the customers of the information services vendor) for the use of the public network to access the information service vendors' facilities. The exemption was originally allowed in 1983, when access charges for other network users first went into effect. It was based on concerns about potential difficulties for local network carriers with respect to their ability to monitor billing minutes, and also the impact of higher rates on the development of the information services industry. The exemption has meant that information service providers typically continue to pay the flat-rate local business line rates, rather than a usage based fee for access.

NTIA, as well as many in the enhanced services industry and the Congress, adamantly opposed the FCC's plan to end the enhanced service provider (ESP) exemption from access charges. NTIA noted that it is inappropriate to treat ESPs as interexchange carriers (which are subject to access charges), because there are significant operational differences in their systems. Further, NTIA took the position that the FCC should not have, in the first instance in 1983, assumed that ESPs would ultimately be treated as interexchange carriers, thereby granting only a temporary exemption.[59]

Following such opposition, the FCC has indicated that it will not, at this time, move to impose access charges on ESPs.[60] Nevertheless, there is concern in the information services industry about possible termination of the "exemption" at some future time, or even efforts to capture such charges indirectly -- perhaps through pricing established in CEI or ONA tariffs.

The FCC Continues To Play A Crucial Role With Respect To Information Services Growth In This Country. Carrying out its statutory responsibilities over the years, the FCC has strived to promote development of information services in an unregulated environment, but has kept strict control over the conditions under which regulated carriers could provide those services.[61] Most recently, the FCC has taken significant steps in instituting both CEI and ONA to spur further information service development in this country. The manner in which the FCC governs implementation of such plans could have a significant impact on the availability of information services to the public.

The Impact of the AT&T Consent Decree

The Bell Companies Were Initially Prohibited From Providing Any Information Services. In November, 1974, the Antitrust Division of the U.S. Department of Justice filed suit against AT&T. This antitrust action contended that AT&T had violated the Sherman Act. The action challenged AT&T's continued ownership of (a) companies providing about 80 percent of U.S. local telephone service, (b) long-distance operations, and (c) the principal U.S. telephone equipment maker. In January, 1982, the Chairman of AT&T and the Assistant Attorney General in charge of the Antitrust Division announced a negotiated settlement of this litigation. Under the settlement, AT&T was permitted to retain most of the former Bell System's long-distance operations, Western Electric and its world-renowned research facility, Bell Laboratories. Provisions of a 1956 consent decree which had limited AT&T to providing only regulated telecommunications services were vacated, and the divestiture of some $100 billion in assets was required.

Under the new consent decree, AT&T was required to divest its local telephone operations, except for two smalof scope and scale, in addition to selling or renting such terminals to consumers. Thus, vertical integration may optimize mass market consumer services. There is little risk of anticompetitive behavior by the Bell companies at present because this mass market demand is not being met by other companies at the present time.

The Bell Companies Were Initially Prohibited From Providing Any Information Services. In November, 1974, the Antitrust Division of the U.S. Department of Justice filed suit against AT&T. This antitrust action contended that AT&T had violated the Sherman Act. The action challenged AT&T's continued ownership of (a) companies providing about 80 percent of U.S. local telephone service, (b) long-distance operations, and (c) the principal U.S. telephone equipment maker. In January, 1982, the Chairman of AT&T and the Assistant Attorney General in charge of the Antitrust Division announced a negotiated settlement of

this litigation. Under the settlement, AT&T was permitted to retain most of the former Bell System's long-distance operations, Western Electric and its world-renowned research facility, Bell Laboratories. Provisions of a 1956 consent decree which had limited AT&T to providing only regulated telecommunications services were vacated, and the divestiture of some $100 billion in assets was required.

Under the new consent decree, AT&T was required to divest its local telephone operations, except for two small nonconsolidated affiliates.[62] Eventually, ownership of 22 Bell Operating Companies (BOCs) was organized under seven newly-created independent holding companies. Following protracted court proceedings, a "modification of final judgment" (MFJ) differing somewhat from the initial settlement agreement was entered by U.S. District Court Judge Harold H. Greene in August 1982. Actual divestiture took place in January, 1984.

Pursuant to the decree, AT&T became free to provide information services, although it was prohibited from providing electronic publishing over its own network for a period of seven years. Given their control of local bottleneck facilities, however, the Bell companies were subjected to more extensive line-of-business restrictions. These restrictions initially included an absolute ban on the provision of information services, as well as a prohibition against providing interexchange service or engaging in manufacturing. The court also placed a limit on the amount of non-telecommunications business of the Bell companies.[63]

The prohibition against Bell company entry into information services is defined in Section II(D)(1) of the decree as the:

> *offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information which may be conveyed via telecommunications, except that such service does not include any use of such capability for management, control, or operation of a telecommunications service.*

As indicated earlier, this definition is similar to the FCC's definition of enhanced services, and for purposes of this report, the differences are not critical. With respect to both enhanced and information services, the decree has had a significant impact by keeping a group of major firms out of the market, despite their expertise and potential to foster information services growth in this country.

In a previous study (the NTIA Trade Report), NTIA recommended changes in the AT&T consent decree that would permit the entry of the Bell companies into manufacturing subject to screening process for joint ventures with foreign-based firms. Although NTIA did not specifically address information terminals in that study, it did recommend that the Bell companies be permitted to manufacture customer premises equipment (CPE) such as telephone handsets, key telephone systems, and private branch exchanges among other things.[64]

As currently envisioned, the information services terminal may be a logical technological advancement of the telephone handset. The NTIA Trade Report addressed the consumer handset market and concluded that restrictions on manufacturing of handsets accomplishes very little, and that there is simply no good reason to preclude the Bell companies from manufacturing handsets and related terminal equipment.

Vertical integration is potentially important when considering the mass market segment for ordinary telephones, which is unlikely to purchase a personal computer. Such a group, if it is ever to embrace information services, may accept a low-cost easy-to-use information services terminal that is marketed as an "advanced telephone" rather than a computer.

Marketing incentives would be optimized if the Bell companies could manufacture the terminals and realize economies of scope and scale, in addition to selling or renting such terminals to consumers. Thus, vertical integration may optimize mass market consumer services. There is little risk of anticompetitive behavior by the Bell companies at present because this mass market demand is not being met by other companies at the present time.

Bell Companies May Now Provide Information Service Gateways And A Few Information Services. In its first triennial review of the AT&T consent decree, the court modified the absolute ban on Bell company provision of information services. While the Bell companies, the FCC, NTIA and the Department of Justice all sought to end this particular line-of-business restriction, many potential competitors remained adamant that the restriction must not be lifted.

Nevertheless, the court did make some modifications, while otherwise continuing the restriction. The court ruled that the Bell companies could provide electronic white pages -- but not electronic yellow pages.[65] Also, the court very recently ruled that they may provide "information transmission", or transmission gateways,[66] by which others can provide information services to the public.[67] Finally, the court very recently ruled that the Bell companies may also provide electronic mail and voice messaging services, in order to promote development of a mass market in these areas.[68] The court has otherwise largely continued to prohibit the firms from engaging in the generation or manipulation of content, however, and has thus largely r2estricted their role in the market to the provision of an information service "conduit" for others to use.

NTIA, acting as the President's principal adviser on telecommunications and information policy matters, has petitioned the FCC for a declaratory ruling pursuant to the Communications Act of 1934, as amended, to enable the Bell companies to provide information services, based upon an FCC determination that such provision is in the public interest.[69] NTIA indicated that the FCC should take this step to eliminate controversy and needless uncertainties caused by the consent decree court's rulings.

NTIA asserted that this action is essential to ensure the competitive development of information services, which is critical to American industry, businesses, and the public at large. Without these "electronic tools," American enterprise will be less able to provide the goods and services, investment, and employment opportunities needed for the growth of the American economy.

In promoting Bell company provision of information services on a broader scale, NTIA indicated that the issue is not simply whether American telephone subscribers will have access to new telephone-based services comparable to those available overseas. Rather it is also a question whether national communications assets will be more efficiently used, and whether network changes that would facilitate innovation on the part of other firms will be made by the Bell companies in an expeditious manner.

NTIA also indicated that communications trade considerations are important. The practical effect of the Court's restriction on information services has been to drive functions or "intelligence" from the public telephone network, and to stimulate demand for terminal equipment embodying capabilities the network could otherwise provide. Because foreign-based firms have a larger share of the terminal equipment market than of the network products market, the result has been and will continue to be, to make the U.S. trade deficit in this key sector artificially larger than it might otherwise be. The changes the District Court has permitted are unlikely to alter this undesirable situation significantly.

NTIA has also asserted that the FCC, not the courts, is primarily responsible to ensure the nationwide availability of communications services, and is explicitly directed "to encourage provision of new technologies and services to the public."[76] NTIA noted that in its Third Computer Inquiry (Computer III) ruling, the FCC established a carefully balanced regulatory scheme (with competitive safeguards) for the provision of unregulated information services by the Bell companies. The FCC determined that the approach it was adopting would, first, afford the Bell companies a positive incentive to make desirable network changes in a timely manner; second, maximize the potential for innovation, third, ensure widespread access to new services by all customers; and fourth, stimulate more efficient use of national communications assets and resources.[77] Accordingly, NTIA maintained that the FCC, not the consent decree court, should govern the extent of Bell company entry into information services.

The GTE Consent Decree

While independent telephone companies are not subject to all of the FCC's non-structural safeguards, or the AT&T consent decree's ban on provision of information services applicable to the Bell companies, GTE is subject to certain constraints under a 1984 consent decree. Under that decree, GTE's local telephone operating companies may provide information services, but only through separate subsidiaries, or through accounting separation.[78] Other requirements were also delineated, including one specifying that any facilities made available by the GTE local public networks for GTE's information services must also be made available to others on an unbundled, tariffed basis. Another provision provides that in the event the AT&T consent decree's prohibition on Bell company entry into information services is lifted, the GTE separation requirements would also be terminated.

GTE is involved in information service activities via their "Telemessenger" voice mail and storage service; in electronic mail marketed by US Sprint (jointly owned with United Telecom); via the GTE "Teleguide" tourist information service for travelers in Florida; in the development of "Mainstreet," an interactive shopping service provided over cable TV; and electronic funds transfer in California and Florida, where the company owns automated teller machines.[73]

Major Trends and Conclusions

Over the near term of three to five years, the business information services market will continue to flourish, growing at an annual rate 20-30 percent based on growth rates over the past few years. The business information market is currently at $5 billion annually with projections of $15 billion annually in 1992.

The residential market is about $115 million annually with slightly over one million subscribers all of which have personal computers, modems and telecommunications software. Viewed in the context of the total U.S. telecommunications industry in 1987 -- with service revenue exceeding $127 billion, and serving 83 million American households -- the residential information services market reached a rather small percentage of the U.S. population.

Although the residential market has been growing at an annual rate of about 20 percent, the growth rate is largely a function of the penetration of personal computers in households. Thus, as the growth rate of computers slows, the growth rate of residential information services will also slow. Some growth stimulation may occur as a result of the Bell Companies marketing their gateways, and the entry of information vendors such as Prodigy, but this market will mostly attract home computer users.

The future development of the information services industry in this country is vital to American companies becoming more competitive both at home and abroad and to the ability of all Americans to become part of the economic and social fabric of an electronic society, just as they are part of the voice telephone society.

The U.S. online information services industry is strong and thriving for larger business users and those willing to purchase a personal computer, modem, and software, and to subscribe to particular information services.

A major component of the mass market, however, is the household with an ordinary telephone subscriber who is not likely to own a personal computer, and who would benefit from availability of a low-cost, user-friendly information services terminal.

Removal of certain regulatory impediments could accelerate the growth of successful mass market information service offerings in this country, by allowing our largest local telephone companies to offer more information services and to produce suitable information services terminals.

The development and marketing of terminals, as well as of information services, should generally be left to the competitive marketplace, although appropriate government policies regarding the offering of information services by regulated common carriers can serve to further spur such growth.

Notes

1. "NTIA Information Services Report," NTIA Report 88-235, F. Matos, Project Manager, NTIA, August 1988.

2. The listing draws on the Huber Report developed for the Department of Justice (The Geodesic Network -- 1987 Report on Competition in the Telephone Industry, 1987) which, in turn, draws on SRI International, Information Gateways, 1985. The listing also draws on a report prepared by Link Resources for ADAPSO and used as Appendix A to the ADAPSO comments in the FCC proceeding to impose access charges on enhanced services providers (Comments of ADAPSO on Amendments of Part 69 of the Commission's Rules Relating to Enhanced Services Providers, CC Docket 87-215, Sept. 24, 1987).

3. The Videotex Industry Association defines videotex in a broad manner as easy-to-use, interactive electronic services. This definition encompasses a very broad range of services including audiotex, CD-ROMs, etc. The definition used in this study will be narrower, primarily covering those non-entertainment services delivered via telecommunications networks and displayed on a video terminal.

4. Directory of Online Databases, Cuadra/Elsevier, vol. 9, no. 1, Jan., 1988.

5. United States v. Western Electric Co., C.A. 82-0192, slip op. (D.D.C. Mar. 7, 1988).

6. Amendment of Part 69 of the Commission's Rules Relating to Enhanced Service Providers, 2 FCC Rcd. 4305, 4306, CC Docket No. 87-215, (1987).

7. "Information Industry Bulletin 1987 Online Index," Information Industry Bulletin 2/4/88, Digital Information Group, Stamford, CT, used with permission.

8. "United States Consumer Videotex Forecast - 1986 to 1991," LINK Resources Corp., Report No. 0180, Jul., 1987.

9. "United States Consumer Videotex Forecast, 1987-1992," LINK Resources Corp., Report No. 0206, May, 1988.

10. Appendix A to Comments of CompuServe Incorporated, In the Matter of Amendment of Part 69 of the Commission's Rules Relating to Enhanced Services Providers, CC Docket No. 87-215, Sept. 24, 1987.

11. "Videotex Project Reviews VI," H.J. Sloan III and W. W. Talarzyk, College of Business, Ohio State University, Working Paper Series, WPS 88-20, Apr., 1988.

12. 18/ Appendix B to CompuServe comments.

13. Information provided by General Electric Information Services Company, Rockville, MD, Apr. 1988.

14. Information provided by The Source, McLean, VA, Apr., 1988.

15. "Are IBM and Sears Crazy? or Canny?" Fortune, vol. 116, no. 7, Sep., 28, 1987, p. 74.

16. Information provided informally by Prodigy, May. 1988.

17. Information provided informally by Prodigy, May, 1988.

18. Data obtained from Sloan and Talarzyk note, original source: Viewdata/Videotex Report, vol. 8, no 2, Feb., 1987, p. 5.

19. Comments of Quantum Computer Services Inc., In the Matter of Amendments of the Commission's Rules Relating to Enhanced Service Providers, CC Docket No. 87-215, Sept. 24, 1987, p. 5.

20. Ibid.

21. Information provided informally by Quantum Computer Services, Inc., May, 1988.

22. Correspondence and brochure provided by Boston CitiNet, May, 1988.

23. "User Profile," Boston CitiNet, Feb., 1987.

24. "Suddenly, Videotex is Finding an Audience," Business Week, no. 3021, October 19, 1987, p. 92.

25. "NYNEX Reveals Network Plans and Research at Hush-hush Meeting in Boston," Interactivity Report, no. 3, June, 1987.

26. "NYNEX, New England Telephone Run Online Survey Via Boston CitiNet, Gateway Due In Summer," Interactivity Report, no. 13, Mar., 1988.

27. All information on the Cleveland Free-Net and the Society for Public Access Computing was provided by Dr. T.M. Grundner, Cleveland Free-Net Project Director, and Executive Director of the Society, May 17, 1988.

28. Information provided by Mr. Paul White, Public Affairs Director, U.S. Videotel, Houston, TX, May 18, 1988.

29. "U.S. Videotel: Another Try at American Videotex," M. O'Leary, Online, vol. 12, no. 2, Mar., 1988, p. 72.

30. Mr. Paul White, U.S. Videotel.

31. Mr. Paul White, U.S. Videotel.

32. Comments of Telenet Communications Corporation, Attachment A, p. 13, Amendments of Part 69 of the Commission's rules relating to Enhanced Service Providers, CC Docket No. 87-215, Sept. 24, 1987.

33. Information provided by Burnell Wright, LINK Resources, Jul., 1988.

34. "Highlights of the Online Database Field: New Technologies for Online," M.E. Williams, Proceedings of the Ninth National Online Meeting, New York, NY, May 10-12, 1988, Learned Information, Inc., Medford, NJ.

35. Brochure, Mead Data Central, 1988.

36. Sloan and Talarzyk.

37. Information provided by Suzanne E. Hohman, Account Executive, CompuServe, June 16, 1988.

38. Brochure, Business Services Overview, No. CS-1213(05/88), CompuServe, Columbus, Ohio.

39. "The Electronic Age of Export Licensing: "ELAIN" Joins "STELLA" to Cut Processing Time," L. Mercer, Business America, vol. 109, no. 5, Department of Commerce, Feb. 29, 1988.

40. LINK Resources report, May, 1988.

41. "U.S. Industrial Outlook 1988," Figure 30-2, p. 30-7, International Data Corporation, 1988.

42. Information provided informally by Electronic Industries Association, Apr., 1988.

43. LINK Resources report, May, 1988, p. 1.

44. "Industry Vision and Introduction to the VIA Gateway Study," Videotex Industry Association, Draft No. 4, Mar. 8, 1988.

45. LINK Resources report, May, 1988, p. 7.

46. Videotex/Teletex-Principles and Practices, A. F. Alber, 1985, McGraw-Hill, New York, NY.

47. Information provided informally by Mr. Harold Krall, Chief Executive Officer, Cardinal Technologies, May, 1988.

48. Information provided informally by Mr. Henri Laban, Telic Alcatel, Vice President Operations - North and South America, June 13, 1988.

49. Regulatory and Policy Problems Presented by the Interdependence of Computer and Communications Services and Facilities (Computer I), 28 FCC 2d 267 (1971), aff'd in part and rev'd in part sub nom. GTE Service Corp. v. FCC, 474 F.2d 724 (2d Cir. 1973), decision on remand, 40 FCC 2d 293 (1973).

50. Second Computer Inquiry (Computer II), 77 FCC 2d 384 (1980); recon. 84 FCC 2d 50 (1980); further recon. 88 FCC 2d 512 (1981); aff'd sub nom., CCIA v. FCC, 693 F.2d 198 (D.C. Cir. 1982); cert. denied, 461 U.S. 938 (1983); further recon., FCC 84-190 (released May 4, 1984).

51. In this discussion, we use the terms information services and enhanced services interchangeably. Neither the MFJ court nor the FCC has ever determined the exact overlap between their respective definitions of the pertinent terms. (See discussion below for MFJ definition of information services). Further, it has been generally acknowledged that some, if not all, enhanced services are information services.

52. BOC Separation Order, 95 FCC 2d 1117 (1983), recon. denied, FCC 84-252, aff'd sub nom. Illinois Bell Tel. Co. v. FCC, 740 F.2d 465 (7th Cir. 1984)

53. Third Computer Inquiry (Computer III), 104 FCC 2d 958 (1986), recon. FCC 88-9 (Phase I) and FCC 88-10 (Phase II) (released Feb. 18, 1988).

54. Other non-structural safeguards include disclosure rules regarding network and customer information.

55. While a number of CEI plans are still pending before the FCC, some have already been accepted, subject to conditions for modification. See e.g., In the Matter of the Bell Atlantic Telephone Companies Offer of CEI to ESPs and Pacific Bell and Nevada Bell Plan for Provision of Voice Mail Services, (Common Carrier Bureau), DA 88-765, released May 23, 1988; and In the matter of AT&T Plan for the Provision of Transaction Services, (Common Carrier Bureau), DA 88-671, released May 11, 1988.

56. Other proposed principles reflected the need to rely on market forces to the extent feasible, for the Commission to limit its interest in ONA to interstate services within its jurisdiction, for ONA offerings to be easily identifiable and

subject to appropriate rate regulation, and for ONA not to stifle other network innovation or harm users of existing network services.

57. See NTIA Comments in CC Docket 88-2 (Phase I) filed Apr. 18, 1988, and Reply Comments filed May 26, 1988.

58. Notice of Proposed Rulemaking, Amendment of Part 69 of the Commission's Rules Relating to Enhanced Service Providers, CC Docket No. 87-215, released Jul. 17, 1987.

59. See NTIA comments filed in CC Docket No. 87-215, Sept. 22, 1987, at P. 7.

60. FCC Order, CC Docket No. 87-215, FCC 88-151, released Apr. 27, 1988.

61. The FCC's ancillary authority to control the conditions under which carriers provide regulated services is found in Title I of the Communications Act. Included are Section 151, dealing with the need to foster availability of nationwide services at reasonable rates, and Section 157 dealing with the promotion of new technologies and services.

62. United States v. American Telephone and Telegraph Co., 552 F. Supp. 131 (D.D.C. 1982), aff'd sub nom., Maryland v. United States, 460 U.S. 1001 (1983).

63. The Court established a waiver process, however, whereby the carriers could seek permission to enter an otherwise restricted line of business.

64. "NTIA Trade Report: Assessing the Effects of Changing the AT&T Antitrust Consent Decree," National Telecommunications and Information Administration, Feb. 4, 1987.

65. See United States v. Western Electric, 673 F. Supp. 525 (D.D.C. 1987) (MFJ Modification Order), Civ. Action No. 82-0192, Sept. 10, 1987.

66. According to the decree court, the Bell companies may engage in the following functions to the extent necessary to provide the gateway: provision of data transmission, address translation, protocol conversion, billing management, introductory information content, and "help" for the user. They may not, however, offer a menu of services, as the court believes that would involve them in control of content. The Bell companies' ability to share in the profits of information services ventures offered through their gateways has been constrained as well.

67. See MFJ Modification Order, and United States v. Western Electric (Further Modification Order), Civ. Action No. 82-0912, Slip Op. Mar. 13, 1988.

68. Further Modification Order, March 13, 1988.

69. "Petition for Declaratory Ruling of the National Telecommunications and Information Administration," In the Matter of the Bell Operating Companies' provision of Information Services, filed with the Federal Communications Commission, Nov. 24, 1987 (See also NTIA Reply Comments and Supplemental Comments filed Jul. 22, 1988.)

70. See 47 U.S.C. Sec. 151, 157 (1986).

71. Letter of Alfred C. Sikes, Assistant Secretary for Communications and Information, to Honorable Dennis R. Patrick, Chairman, Federal Communications Commission, Nov. 24, 1987.

72. United States v. GTE, 603 F. Supp. 730 (D.D.C. 1984).

73. Information provided by S. Shawhan, GTE, Washington, D.C., Apr., 1988.

X

Electronic Banking and Financial Services

by John P. Fernández

The convergence of computers and communications technologies has had a profound effect on banking and other financial services. It has changed the basic nature of the financial services marketplace radically, altering what services are provided, how, by whom, to whom, and how those services are priced and used as well.

No other industry sector has so thoroughly embraced this convergence. Banks and brokerage houses now spend approximately 4.5 percent of their revenues on information systems. This is far more than utilities, heavy industries, or retailers have been willing to invest.[1] Banks accounted for 31 percent of the total U.S. dollar sales volume in computer software and services in 1986.[2] Among brokerage houses, Merrill Lynch has made significant investments in domestic and international communications systems.[3] Yet when a major accounting firm surveyed 250 senior executives at financial institutions, 25 percent indicated a lack of sufficient information to decide how best to implement this technology.[4] Clearly, there is still room in this industry sector for greater use and understanding of communications and data processing technologies and their applications.

Development of electronic financial services based upon sophisticated communications technologies has helped control the cost of banking[5] while enabling companies and individuals to obtain the most modern and broad range of financial services wherever they locate their offices or homes.

The affordability and availability of data processing and communications technologies has reduced entry barriers to the financial services market in many instances.[6] Through electronic banking networks, smaller and more remote institutions have the potential to offer their customers a range of services at least equivalent to those offered by larger, urban institutions. These smaller institutions cannot only retain their local clientele, but may attract customers from other markets. With a relatively small capital investment and participation in one or more shared networks, these institutions can remain competitive with larger institutions.[7]

In fact, the existence of these capabilities permits previously unrelated businesses to enter the financial services market, offering a number of products traditionally within the province of banks (e.g., Sears, Roebuck and Co.; Merrill Lynch; AT&T; and American Express).

Lynch; AT&T; and American Express).

It has increased the speed and reduced the cost of processing financial transactions, and provided new tools to fight fraud, such as dial-up credit authorization.

Increased competition among financial service providers has given consumers choices in price and service they would not otherwise have. Consumers can now have access to their funds virtually anywhere at any time, e.g., at banks, automated teller machines (ATMs), supermarkets, shops and restaurants, or from a telephone, worldwide, day or night. Costs to consumers, not just to financial institutions and vendors, of paying bills have been reduced. Consumers are also less prone to face the lack of acceptance of their checks or credit cards now that their access to funds can be verified electronically.

This array of actual and potential benefits has not come without concurrent costs and risks. The dramatic changes highlighted above have helped to undercut traditional regulatory structures in the financial services market, and this process of change is far from complete. Issues such as whether to allow more interstate competition and the extent of state regulatory authority, familiar in the telecommunications context, are very much alive in the financial services industry as well. Questions such as the uneven application of regulation and the fact that some participants in markets are strictly regulated while others are not regulated at all (a problem familiar to communications policymakers) are widely debated in the financial services sector.

The growth of electronic banking and remote access to bank accounts and financial data has also raised concerns with respect to economic stability, institutional safety, computer crime, data and network security, and personal privacy. These are systemic risks. It is possible, for example, to collect vast amounts of information regarding an individual's spending and saving habits for sale to any interested party. Indeed, some of the same communications and data processing technologies that help banks and merchants fight credit card fraud also present new opportunities for theft and abuse.

Financial institutions, vendors, business and individual consumers have spoken clearly in the marketplace.[8] Electronic banking will not only remain a part of daily life, it will become an even more essential and expected one as financial institutions increasingly rely upon electronic capability to attract depositors and investors, and the volume of electronic funds transfers (EFTs) continues to grow.

The purposes of this study are to examine the status of electronic banking and financial services in our society, to consider their impact, to forecast some of the major trends that will shape this industry through the end of the century, and to provide some basis for the consideration of Government policies to encourage the continued development of electronic financial services.

Key Industry Statistics

Historical Overview

From the earliest days of the telegraph and telephone, communications technologies have been used to transfer funds and conduct financial transactions. Western Union Corporation has been the dominant company in the wire transfer business, which involves the transmission of a payment authorization via telegraph lines. Wire transfers constitute a $2.4 billion market, of which Western Union, with 10,000 independent agents, maintains a share of about $169 million.[9]

Electronic banking, integrating computer and communications technologies, had its genesis in a series of developments in the 1950s and 1960s. The simple need to process ever-increasing volumes of paper transactions led to the use of computers to increase the speed and accuracy of clearing and settlement functions. Once the hardware was in place, banks continued the development of software and networks to better exploit their investment in data processing capability. Banks sought new ways to conduct and process financial transactions faster and with less paper than ever before, to improve efficiency, reduce costs and personnel, and to attract customers through higher returns, greater access and convenience. Similarly, computerization provided new and enhanced investment opportunities through the reduction of response time and the creation of a new, interdependent global marketplace.

In the 1950s, banks shifted their focus from big business customers. They began to pursue a retail banking market targeted at small business and individual customers. As a consequence, however, the volume of check transactions increased at rates which alarmed financial institutions. During the economic boom years of the late 1960s and early 1970s, check volume increased at annual rates of seven to ten percent.[10] Manual transaction processing could not keep pace with these developments.

Banks increasingly used computers to cope with the burden of paperwork. They turned to techniques such as magnetic ink character recognition (MICR), i.e., the encoding of checks to allow some automated processing.

Also in response to increasing check volume, automated clearing houses (ACHs) and the communications networks interconnecting them were created in the early 1970s. ACHs were introduced to totally eliminate the need for paper-based transactions. With their ability to process large volume transactions at a fraction of the cost of checks, ACHs formed the foundation of EFT.

Once the ACH infrastructure was in place, other electronic financial services were developed. In the late 1970s, the first automated teller machines (ATMs) were being installed by banks in major urban areas. These were single-bank, proprietary networks at first, but quickly evolved into shared networks. Point-of-sale (POS) direct-debit systems followed, pushed by retailers seeking to reduce losses from bad checks and credit cards and increase the speed of receipt of payments.

With the exception of the wire transfer industry, the use of telecommunications technologies for EFT and other electronic financial services has taken place almost entirely during the last 20 years, as data processing and communications technologies began to converge. New capabilities have led, and continue to lead, to new applications for banks and other financial institutions.

Technologies Used

To meet the varied needs of its business and individual consumers, financial institutions in the United States have put to use a wide variety of communications equipment and technologies acquired under diverse ownership, lease, tariff, and other arrangements.

Financial institutions today use, and sometimes own, satellite transponders and earth stations, private microwave and fiber optic facilities, and sophisticated computerized switches for message and clearing functions. They may link their branches within a small town through dial-up access to the public-switched network, or they may have established national and international systems through dedicated packet switched networks on private leased lines or their own facilities.

Consumers may be served through ATMs; POS terminals, either one of which may involve on-line or ACH processing; videotex, using either personal computers with modems or videotex-only terminals; voice response systems; and smart cards.

Capacity, cost, control, speed, reliability, and security have all been necessary criteria for the development of these systems. Fiber optics presents probably the optimum medium for the transmission of financial information: it is reliable, fast, highly resistant to intervention or interference, and has vast capacity. In a quarter of a second, the entire contents of the Encyclopedia Britannica can be transmitted over a fiber optic line with a probable error rate of one letter. Accuracy and freedom from distortion are critical to the transmission of financial data.

Impact on Global Economy

Financial service providers are a major impetus for the development of advanced telecommunications and computer applications. As an industry, they are a strong force for economic efficiency and change.

Electronic banking has created a constant global marketplace requiring almost instant investment decisions and 24-hour access to capital.[11] It permits currency traders in Tokyo to participate in investment opportunities in London, using a clearing house in Los Angeles. Using computers linked by satellite and earth stations, loans can be applied for, approved, paid and repaid within a fraction of a day.

Telecommunications increases efficiency and reduces costs by allowing the same mainframe computer in South Dakota, for example, to be used by firms in

Europe and Asia through submarine cables, or satellites and Very Small Aperature earth stations (VSATs).

Communications technologies have linked the data processing systems of financial institutions throughout the world in order to allow the exploitation of investment opportunities. This infrastructure will grow and improve as more fiber optics and open, digital networks (or ISDN - for Integrated Services Digital Network) are developed and installed.

Generation and Movement of Capital. In the late 1970s, the governments of the noncommunist world relaxed restrictions on the international movement of capital, thereby fostering an interrelated, more integrated global market. Communications links between branch, subsidiary, and affiliated institutions (e.g., correspondent banks) located in the United States and throughout the world have made it possible to exploit new or deregulated markets. When the data processing capabilities of these institutions are added to the communications network, investment opportunities are vastly increased. Financial institutions which have these capabilities are much better able to obtain capital, transmit funds, make loans, and respond quickly to the world's rapidly changing markets.

Now ten years old, the Society for Worldwide Interbank Financial Telecommunications (SWIFT) electronically links more than 1500 banks in over 50 countries, carrying 400,000 funds transfer messages a day.[12] SWIFT does not provide EFTs; it merely allows participants to communicate with each other in the negotiation of transactions. Nearly one million messages per day are sent through SWIFT.

Major multinational banks often operate private networks (e.g., Citicorp and Manufacturers Hanover Trust), or lease facilities from independent vendors (e.g., Telenet, Tymnet and GE Information Services Corporation).

EFTs are cleared through the Clearing House Interbank Payments System (CHIPS), a private clearing house owned by 12 major New York banks. CHIPS links 140 financial institutions in New York City. An almost identical system exists in London, the Clearing House Automated Payment Systems (CHAPS). The actual settlement, or final payment, of transactions is generally accomplished through FedWire, a computer and Telex system operated by the Board of Governors of the Federal Reserve. FedWire links some 6,300 financial institutions in the U.S.[13]

On a smaller scale, EFT systems permit individuals access to financial services throughout the world. American Express operates a network of 37 nodes. Through this network, consumers have access to 10,000 ATMs in 16 countries and 1.6 million POS terminals in 25 countries. Transaction authorization at these terminals is on-line and immediate.[14]

Foreign Exchange. The exchange of foreign currencies is a constant market in the truest sense. When international exchange rates were allowed to float in 1972, 24-hour trading became a necessity in order for firms to remain in business, not just competitive. While London, with daily volume at approximately $100 billion, is the world center of foreign exchange, traders pursue their business in each financial center as it opens. Trading shifts with the business day from Europe (London and Zurich) to the Americas (New York, Chicago, and Los Angeles), Australia (Sydney), Western Asia (Tokyo), Eastern Asia (Hong Kong and Singapore), finally returning to Europe.[15] Each financial center is inextricably linked by satellite and data lines. Thus, fluctuations in one center will undoubtedly affect trading in the next.

Multinational corporations use financial services networks and their own, in-house currency traders to maintain a diversified, profitable money spread in international currency markets.

Impact on Domestic Economy

Commercial and investment banking play a critical role in the nation's economy. In 1980, for example, the retail financial services industry contributed $100.04 billion, or five percent of the U.S. national income.[16] Electronic banking and other financial services, in turn, make an essential contribution to this industry.

For 1984, it is estimated that there were 109 billion payment transactions in the United States whose total value came to approximately $185 trillion. While there were 68 billion currency transactions, the total value of those transactions only came to about $1 trillion. Checks accounted for 39 billion transactions, but their total value was about $24 trillion. In contrast, there were only two billion electronic transactions, but these transactions were valued at about $160 trillion.[17] Thus, small-value payments are predominately transacted in cash, while large-value payments are transacted electronically.

Electronic banking can provide greatly enhanced economies of scale. Because of satellites and ground networks, processing centers can be located virtually anywhere. Banks in New York or San Francisco may use a central processing computer located in South Dakota or Missouri (with their lower real estate and labor costs and possibly higher unemployment) to transfer funds, process credit card transactions, and clear and settle accounts.

One example of how electronic banking can create new efficiencies is the reorganization and expansion of First Interstate Bancorp. In 1976, First Interstate consisted of 21 banks in 11 Western states which were largely independent. Under new management, First Interstate centralized authority, increased its flexibility, reduced expenses, and addressed problem loans. It now consists of 23 banks in 12 Western states, making it the ninth largest bank holding company in the U.S. In addition, First Interstate operates a franchise program in which it offers its technology, support services and name, while the franchisee retains local ownership and control. Thirty-eight banks with combined assets of $4.6 billion have joined the First Interstate System. Since 1978, First Interstate's assets have increased from $25.1 billion to $49.7 billion. Net income has also increased from $152 million to $302 million.[18] Underlying the expansion, reorganization and franchising program is First Interstate's computing and communications infrastructure. First Interstate operates the second largest proprietary automated teller network with over 1,300 machines and 4.3 million cardholders.[19] Even on a regional level, such an infrastructure allows banks to share costs, data processing facilities, message and clearing services; to centralize management, and to create an interrelated, interdependent (albeit dispersed) organization.

Even a cursory look at the electronic banking marketplace produces numbers of staggering proportions. By 1980, approximately $140 trillion was changing hands annually in the U.S. economy, and $6 out of every $7 of this total moved electronically at some stage.[20] Some nine thousand financial institutions in the United States are members of 175 computerized payments systems.[21]

Traditional paper-based payment methods, too, have become dependent on modern data processing and communications technologies. Financial institutions must process some 44 billion checks,[22] 3.5 billion credit drafts, and over 30 billion shares of securities traded each year.[23] Without the benefit of electronic capabilities, it would be impossible to process such high transaction volumes.

Services

Today, the convergence of computers and communications technologies is a necessary and driving force in the provision of a plethora of financial services to consumers and businesses: wholesale and retail commercial banking, investment banking, foreign exchange, multicurrency accounting, credit analysis, employee contribution plans management, securities and commodities trading, price quoting, credit verification and authorization, check authorization, POS direct-debit and ATM transactions, voice response, home banking, and smart cards are the more significant offerings. A selection of these services are detailed below.

Automated Clearing Houses. The foundation of the EFT industry, ACHs apply computers to the wire transfer of funds. Unlike more costly on-line systems, ACHs use magnetic tape to collect data, which is entered through batch files rather than continuously. However, the data is now transmitted electronically, whereas magnetic tapes were once "bicycled" from sender to receiver. ACH transactions are faster, safer, and far less costly than checks. They are used particularly for large scale, routine transactions, such as payments to employees, beneficiaries, and suppliers. Transactions are processed overnight; rather than being instantly available, funds are generally available the next day.

The most heavily used ACH is operated by the U.S. Department of the Treasury. Some 45 percent of the Social Security and civil service retirement benefit and federal salary payments are deposited directly into recipients' accounts at their financial institutions. As of August 1987, some 260 million such payments were being processed annually.[24]

In 1975, 32 regional ACHs were linked into a nation-wide network. In 1981, there were 276 million ACH transactions, 65 percent of which were Government payments.[25] There were between 700 and 650 million transactions on the ACH system in 1986, which was the first year in which the number of commercial transactions was greater than those generated by the Government.[26] In 1987, there were 936 million ACH transactions, or 78 million per month.[27] This represents a 300 percent increase in six years. Commercial transactions accounted for 56 percent of the total.[28]

The ACH system is becoming even more flexible. It is possible to use ACH instead of on-line systems for POS transactions. In May 1988, the National Automated Clearing House Association (NACHA) amended its operating rules to accomodate non-bank debit card transactions. NACHA developed a new payment format which includes data needed by financial institutions in order to process debits from retailers' cards. The amendments took effect on July 18, 1988.[29]

Automated Teller Machines. ATMs are the electronic financial service most apparent to the U.S. public. Nearly 138 million ATM cards had been issued in the United States by the end of 1987.[30] Located outside banks, in shopping malls, and in other heavy traffic areas, ATMs permit consumers to access their accounts, withdraw cash, make deposits, check balances, transfer funds among accounts, and make credit-card and loan payments. Such transactions can be completed 24 hours a day.

At the end of 1987, there were an estimated 67,000 to 76,000 ATMs in use in the United States.[31] ATM shipments for 1987 were 8,452 units, the first time in four years that annual shipments exceeded those of the previous year.[32] Annual shipments are expected to increase into the 1990s. By 1995, following current trends, some 91,000 ATMs will be in use in the United States.[33] Despite the fact that between 15 and 35 percent of bank customers use ATMs,[34] these machines currently process more than four billion transactions per year.[35] It has been estimated that the annual volume of transactions will increase to five billion by 1992.[36]

The central advantage of ATMs is cost-reduction. An ATM transaction costs about one-half that performed by a teller.[37] ATMs also reduce the number of tellers needed to service customer accounts by reducing the account load per teller.[38] Yet, from a communications perspective, the number of ATM networks in the United States and the variety of software, protocols, interfaces, and switches employed by those networks, present extremely difficult problems for network managers.

To create economies of scale, financial institutions seek participation in a number of regional and national networks. There are 609 ATM networks now in the United States.[39] Approximately 80 percent of the nation's ATMs are linked to at least one of more than 200 regional and seven national shared networks.[40] (In 1987, 77 percent of ATM transactions were conducted on shared network ATMs.)[41] Of those ATMs linked to a network, 60 percent belong to only a regional network; ten percent belong only to a national network; and the remaining 30 percent belong to both a regional and national network.[42] The largest regional networks are the New York Cash Exchange (at almost 6,000 ATMs, the world's second largest shared network),[43] Star System in San Diego, California (the world's fifth largest shared network with more than 5,000 ATMs),[44] and Mac, centered in Philadelphia (4,600 ATMs).[45] The largest national network, Cirrus, has 17,300 ATMs.[46] Typically, these networks are jointly owned by a number of banks.

National and regional shared networks allow consumers from member banks to access their funds, while traveling or after hours, at any linked ATM. At the same time, member banks avoid the need to install ATMs in diverse locations, saving $40-70,000 per unit, while greatly increasing coverage and consumer accessibility. Member banks own the ATMs, and the network provides the switching services which link the units.

Gasoline companies such as Exxon, Mobil, and ARCO have entered into agreements with a number of regional ATM networks. These agreements permit the use of bank ATM cards as debit cards at POS terminals. Exxon has agreements with eight ATM networks, while Mobil has agreements with 20 networks.[47]

Despite such impressive statistics, the potential of ATMs has only begun to be tapped. Only 4.5 percent of all ATM transactions transfer funds from one account to another or involve POS debits, refunds, or verifications.[48] Most thus are used today only to make the traditional payment -- cash -- more convenient. They are not used to their full potential. About 81.5 percent of all ATM transactions consist of cash withdrawals or advances.[49] Manufacturers report that 17 percent of their orders in 1987 were for cash-dispensers, a low-cost, withdrawal-only ATM.[50] As they are used today, ATMs actually encourage cash payments by providing vastly greater opportunities for consumers to obtain currency.

Point-of-Sale Direct-Debit. There has been rapid growth in the number of direct-debit POS terminals installed in the United States. In March 1985, there were only 2,100.[51] There were over 31,000 POS terminals in use at the end of 1986. In March 1988, the number had grown to 49,600.[52] POS Monitor, surveying over 120 EFT networks, now calculates that there are 57,400 POS terminals installed at nearly 50,000 retail locations.[53] Locations include department, grocery and convenience stores, gas stations, and fast food restaurants. Carmody & Company forecast that this number would increase to over 178,000 terminals by 1990.[54] Transaction volume was also expected to grow from $4.2 million per month in 1986 to $130.6 million per month in 1990.[55]

Retailers first established POS networks in order to speed up the processing of credit card transactions, reducing the lag between purchases and receipt of customers' funds. These networks have been converted into direct-debit systems.

In contrast to credit cards, which are still a paper-based payment system, POS is a true EFT system. There are two basic forms of POS: on-line and ACH systems. Customers at POS terminals hand their cards over to employees, who pass the card through a reader. Like an ATM, the reader scans the magnetic tape on the reverse of the card, and is on-line via leased lines to a company data processing center. The customer then enters a personal identification number (PIN) on an attached number pad. The company verifies the card and PIN, then completes the transaction. In the case of Mobil Oil Corporation, asynchronous terminals are used at each gasoline station. These terminals are linked to 13 multiplexer sites, which are in turn linked to a central processing computer in Kansas City, Missouri. This computer is also linked to a variety of ATM network and credit card processors.[56] While Mobil was the first company to accept an on-line debit card and has the greatest number of POS terminals (13-14,000), ARCO has the largest POS transaction volume, almost one million transactions per month from 500 locations.[57]

On-line POS terminals with dedicated or dial-up access to switches and remote data bases provide the ability to instantly debit consumers' accounts and credit retailers' accounts (i.e., debit cards). They also provide on-line, immediate credit and check verification, thereby reducing fraud and losses; and data capture, allowing the rapid development of inventory and sales reports.

Unlike on-line POS, ACH POS terminals will not automatically deduct the cost from customers' accounts, but will compile a daily batch file of debit transactions. This file will be used by the retailers' ACH to obtain funds from customers' financial institutions. ACH POS also differs from on-line POS in that on-line authorization of each transaction is not available. Essentially, ACH POS is a form of "electronic checking." The transaction is completed by the next day, instead of days, but, unlike on-line POS, there is still no guarantee of payment.

Retail gasoline stations account for approximately 32 percent of the installed POS terminals, the largest segment share.[58] They provide the most basic illustration of the economics of POS. Credit card users must pay a higher price for gasoline in order to compensate vendors for the risk of nonpayment and cost of processing these transactions. The consumers' benefits of card convenience and float are offset by direct higher cost. Through POS, however, the vendors' transaction cost is reduced. Payment is instantly credited, thus eliminating the risk of nonpayment. These savings are shared with the consumer. The consumer no longer benefits from the float, but he may purchase gasoline at a lower cost and retain the convenience of a card. At gasoline stations equipped with POS, there are clear consumer incentives for the use of a debit card. At other retailers, however, there may be no price differential based upon payment method, and therefore no consumer incentive to use a debit card apart from mere convenience.

Supermarkets and gasoline stations will continue to account for three out of four installed POS terminals in 1990, although supermarkets will overtake the gasoline stations in possessing the largest number of terminals.[59] Fast food restaurants, now accounting for less than one percent of the terminals, are expected to account for ten percent of all installed POS terminals by 1990.[60]

Exxon and Mobil issue proprietary credit cards which also serve as debit cards in an effort to increase sales and transaction volume while building customer loyalty. Customers have the option of paying in cash, using ATM cards which act as true debit cards, bank credit cards such as Visa and MasterCard, or using the proprietary cards. When a credit or debit card is used at one of Exxon's POS terminals, the transaction is sent to a data center in Houston over leased lines. If the transaction involves an Exxon card, verification is completed using internal files. If it involves an ATM card, the transaction is switched to the ATM network, which completes the verification. Customers may purchase gasoline and other products at company stations equipped with ACH POS terminals and have the cost deducted from their bank accounts. Exxon and Mobil both capture ACH debit transactions on-line at their data centers. A batch file of debit transactions is compiled. At the end of the day, they upload the batch file to Chase Manhattan Bank, based in New York, the companies' joint ACH. Chase sorts the file and sends electronic messages to customers' financial institutions requesting the electronic movement of funds to Exxon's or Mobil's bank. In the event that an ACH debit transaction is returned due to insufficient funds, Exxon charges the transaction to the customer's credit card together with a processing fee. In contrast, Mobil holds the transaction in a separate account and permits the customer to avoid the processing fee by forwarding a check.[61]

In September 1987, a national POS direct-debit network called Entree was launched. Entree is a joint venture of MasterCard and Visa, and is expected to propel POS into prominence. A code will be implanted on the magnetic tape of each participating bank's ATM cards, which will allow the cards to be used in the Entree POS/ATM system. Given the number of MasterCard and Visa cardholders and member banks, Entree should be heavily marketed and widely available to both consumers and merchants. Entree officials expect the system to become well-established in three to five years. By January 1988, some 90 banks and 15 regional networks had agreed to participate.[62] As of June 1988, there were 140 participating financial institutions.[63] There is no set date for the start of operations, but Entree will be introduced by Relay, a regional network serving banks in the Southeast.[64]

Entree's greatest significance is its potential establishment of a de facto universal POS standard, the absence of which has plagued the development of this payment system. However, the National Association of Attorneys General is concerned that Entree would be anticompetitive and might violate Federal and state antitrust laws. The Association is conducting an informal inquiry into the antitrust aspects of the proposed system.[65]

Voice Response Systems. A large number of financial institutions have installed voice response systems (VRSs), which permit individual and business consumers to access their accounts and conduct transactions through touch-tone telephones. Initially, these telephone access systems were used in-bank by tellers. Today, VRSs are an excellent means of providing electronic financial services. They reduce operating costs, are flexible, allow almost universal accessibility over the public switched network, have ready expansion capacity, require little space, and are very inexpensive. The Bank of New England estimates that the cost of a VRS-processed account inquiry is about one-fourth the cost of a teller-processed inquiry.[66] Typical PC-based entry-level systems now cost between $35,000 and $40,000.[67]

A VRS may permit consumers to authorize bill payments, verify whether checks have cleared, transfer funds, make account and loan balance inquiries, check loan rates, get information on other bank products, and access financial information services. Messages prompt the caller to enter account numbers, personal identification codes, and transactions.[68] VRSs may use either digitized prerecorded or synthesized speech. New VRS capabilities include: full-terminal emulation, which allows the performance of any routine teller transaction, including credit applications; and ATM locator services, which correlate the caller's exchange number with an ATM directory and then provide the street address of the nearest ATM.[69]

A number of financial institutions still use the bill payment authorizations gathered from their VRSs merely to generate paper checks which then are mailed to authorized payees. The high cost per transaction deters most banks from offering such services. By interfacing a VRS with an ACH, however, such payments may be processed for a fraction of check costs as a true EFT.

In addition to cost and flexibility, VRSs offer other advantages to financial institutions. They require only that consumers own a touch-tone telephone; no investment in a personal computer or videotex terminal is necessary. VRSs offer a "low tech" means of providing electronic financial services, which does not intimidate computer-illiterate consumers. They are simple to operate. As an alternative to more complex, costly systems, VRSs are an excellent choice.

Home Banking. As opposed to access through a VRS, home banking, for the purposes of this study, refers to interactive, transactional and informational, video-displayed services, or "videotex," offered by banks and other financial institutions, accessible only through some sort of terminal.

Personal computers (PCs) are commonly used as financial service terminals. Despite an estimated base of over 17 million home PCs installed by 1988,[70] only a relatively minute number of consumers now pay bills, transfer funds, check balances, apply for loans, and receive account statements over computers linked via communications equipment to their bank.[71] While it is estimated that PCs have now penetrated into some 22 percent of U.S. households, only 9.5 percent of U.S. households are estimated to own both PCs and modems in 1988.[72] Without a modem and the requisite software, a PC cannot be used to access a home banking service.

The relatively minute number of home banking service users can be attributed to a number of factors: lack of widely available home banking services, highly concentrated markets, the high cost of PCs and the necessary communications equipment and software, the need to arrange access with financial institutions and vendors, and the level of computer knowledge required to set up and use such a system. However, it is also possible to use far less sophisticated, less expensive terminals to access electronic financial services. These devices, such as the French Minitel or AT&T Model 1300 terminals, have self-contained modems. They must be attached to a television receiver or monitor, and lack processing capability.

A small number of banks have established home banking programs for customers owning personal computers, modems, and communications software. Citibank, BankAmerica, and Chemical Bank are the most successful examples.

Since 1981, Citibank's Direct Access service has offered subscribers in the New York City area the ability to pay bills, transfer funds among accounts, trade securities through Citibank Brokerage, and access the Dow Jones news service. Some 15,000 vendors may be paid through the system. Citibank provides the software, which may be used on all major personal computers. Direct Access now has approximately 40,000 subscribers, who pay $10.00 per month.[73]

BankAmerica has offered HomeBanking since 1983, which permits bill payments, funds transfers among accounts, balance and CD rate inquiries, and check orders. Securities trading is an optional service.[74] Over 12,000 vendors may be paid through HomeBanking. In addition, BankAmerica has established a one-way "information gateway": subscribers may access Western Union Corporation's EasyLink videotex service.[75] HomeBanking subscriber numbers are unavailable; however, BankAmerica sold 8,000 AT&T 1300 videotex terminals in the first 18 months of availability.[76] BankAmerica sells the AT&T 1300 for $80.00. HomeBanking is available for $10.00 per month.[77]

Only one other bank operates a home banking program comparable to Citibank's and BankAmerica's. COVIDEA, a joint venture of Chemical Bank of New York and AT&T, offers PRONTO to New York City area subscribers. It may be accessed with either a PC or an AT&T 1300 terminal. PRONTO technology has been licensed to a number of other banks.[78]

The limited availability of consumer-oriented teletex and videotex services, however, has severely limited home banking. There are a number of widely available videotex services which provide home banking options.

CompuServe, the nation's largest general videotex service with over 300,000 subscribers, provides access to a wide range of electronic financial services. These services include: price quotes, options data, Standard & Poor's ratings, brokerage houses, and home banking. As of May 1986, CompuServe had made 24-hour home banking available for subscribers in six states through participating banks.[79]

Prodigy, a joint-venture of International Business Machines Corporation (IBM) and Sears, Roebuck and Co., has begun offering interactive informational and transactional services on an experimental basis in San Francisco, Atlanta and Hartford. Company officials plan to make Prodigy available in most major U.S. markets within two years. System computers will be placed in each local exchange area so that no toll calls will be needed. Largely advertiser-supported, subscribers will be assessed a flat fee of $9.95 per month.[80] Manufacturers Hanover Trust Company is offering home banking through Prodigy, and is processing data for two other banks. Trustcorp Bank of Ohio is developing a software package for participating banks which prefer to process their own data. This package should be available near mid-year 1989.[81]

As personal computer and videotex communications equipment evolves and sales continue, all-digital open networks develop, and consumers' computer knowledge and awareness also improve, financial institutions should increase their efforts to entice system users and thereby increase transaction volume. With the new "information transmission gateways" to be offered by the Bell Operating Companies, home banking appears to be on the verge of significant, long-awaited growth.

Smart Cards. Smart cards, which were developed and are in wide use in France,[82] are plastic cards on which one or more microcomputer chips have been implanted. They are visually indistinguishable from standard credit or ATM cards. Like the magnetic tape on the reverse of those cards, the chips on smart cards may be read by a terminal. However, the chips have far larger capacity for the storage of information than a simple strip of tape, and they are more durable. They are a very inexpensive way to store and send extensive information.[83]

One drawback to smart cards has been that consumers could not access the data stored on their cards unless they were conducting a transaction. Now under development are "super smart cards," which allow the consumer to access the stored data. They resemble credit card-sized calculators, with a keyboard and display screen.[84]

Smart card users can easily carry their total financial data on these cards, like miniature savings passbooks. They allow the banking system to credit or debit funds and distribute cash based upon the data stored in the microchip. All transactions would be recorded directly in the chip. Since the ATM or branch would not need to communicate with users' financial institutions, a "non-network system" may be established. Transactions could be authorized by the card itself at the point of sale. Such a system would eliminate the on-line communications links for smart card transactions, and therefore could be operated at lower cost.

Smart cards are being used at the Royal Bank of Canada now. However, instead of being part of the EFT system, they are an element in Royal Bank's corporate banking security system: Royal Bank issues cards to corporate treasurers, who must insert them into a reader attached to their own personal computers in order to gain access to the Royal Bank's cash management program. If the user enters the incorrect access code three times, the system will permanently disable the card.[85]

The unique possibilities afforded by smart cards also present enhanced risks of fraud or theft, far greater than those associated with credit cards. Because there is no on-line verification, a need for greater security measures exists. One possibility is the use of biometric systems, which are discussed below. The biometric identifier(s) of the cardholder could be stored on the card, then accessed by the terminals' security system, and compared with readings taken from the user. This combination could reduce the risks of fraud or theft significantly.

Computer-Driven Securities Trading. Computers programmed by investment houses and linked by communications networks to stock and futures exchanges are an essential element in securities transactions. Program trading originally referred to the use of computers to execute sales and purchases of large blocks of securities. As computers are now used for more specialized tasks, however, program trading has come to refer to practices involving the simultaneous trading of stocks and stock index futures or options. Two such practices are index arbitrage and "portfolio insurance."

Index arbitrage, the most dramatic form of computer-driven securities trading, attempts to profit from variations in price between stocks and stock index futures. In index arbitrage, computers constantly monitor the prices of each stock within an index, typically the Standard & Poor's 500-stock Index, and the stock index futures traded at the Chicago Mercantile Exchange. The computers are programmed to measure price differences and potential transaction costs. When the computers determine that a profit can be made, they signal the investors. The investors then order the computers to execute the trades, selling in one market and buying in another within seconds. A price divergence may vanish in a minute, so speed is essential.

Portfolio insurance is a form of investment hedge which attempts to minimize the negative impact of price fluctuations in the stock market. Investments in the stock market are split between stocks and stock index futures. When market prices decline, the futures are liquidated. If stock prices continue to decline investors might still be able to sell their shares at the price specified in the futures. This reduces the impact of declining prices on the value and holdings of a given portfolio. If stock prices subsequently rise, investors profit from the increased value of their holdings while taking a loss on the futures. The practice is used by institutional investors which must maintain relative stability, such as pension funds.

Security Methods

Banks and other financial institutions are likely targets for computer crime. They have a critical need to protect the integrity of their communications and the confidentiality of business and individual consumers. They must carefully secure their EFT systems. The Federal Reserve Board, for example, has totally encrypted the FedWire network.[86]

EFT systems, like other data processing systems, face several security risks, both external and internal: human collection (i.e., the theft of disks, passwords, badges or keys), electronic collection (i.e., the interception of satellite or telephone transmissions), and signal collection (i.e., the monitoring and interpretation of mechanical and/or electromagnetic emissions from computers, keyboards and screens). Computer security means the assurance of both systemic and data integrity; it means the control of access to the network and to data transmissions.

Network Integrity. By ensuring network integrity, data integrity is guaranteed. The simplest method of restricting access to the network is by limiting the number of authorized nodes within a network.[87] Access to a terminal, and therefore to the network, is thus curtailed. Other methods of restricting access include passwords, badges, biometry, signature verification, TEMPEST, and the physical protection of hardware (e.g., armored connections).

a. "Work Environments." One example of an internal control for access to data is the creation of various "work environments" within a local network. An environment is a collection of resident applications, displayed in a front-end menu. The user cannot move beyond the environment he or she is authorized to work within. When logging on, a user designates that environment. At the basic applications level, a user may access data bases such as customer and product information, and word processing. At the more complex computing level, a user may create, edit and delete files, use resident programs such as spreadsheets and graphics, or work with the DOS operating system. Access to the environments is based upon profiles of the individuals or groups who are authorized to work within certain applications. A similar system is now used by the pensions division of the Metropolitan Life Insurance Company.[88]

b. TEMPEST. Since the 1950s, it has been possible to collect data by listening to keystrokes and electromagnetic emissions, which are the mechanical and electronic sounds or signals produced by computers, screens, printers and keyboards. These emissions may be monitored by any interested party and interpreted through specially programmed computers. Monitoring can be accomplished without entering a facility through the use of specialized microphones or line taps. Thus, the data displayed on a computer screen can be read accurately from some distant point.

TEMPEST is a process for shielding, suppressing or garbling the mechanical and/or electromagnetic emissions from computers and office equipment. Equipment, rooms, even entire buildings may be shielded through the use of metal-lined cabinets, boxes, doors, walls, and metal-meshed windows. Shielding also must include cables, connections and interfaces. Even if encryption devices are used, data may be collected in cleartext at unshielded interfaces and through transmission lines. While it is now used almost exclusively by Government military and intelligence agencies in situations requiring the highest security, it is possible that financial institutions, motivated by the volume and confidential nature of their transactions as well as consumer demand for stringent protection of their financial records, might also acquire TEMPEST equipment. Of course, the very high cost of TEMPEST protection must first be outweighed by the value of the potential loss.

The U.S. market for TEMPEST equipment grew approximately 32 percent from 1985 to 1986, and was expected to grow an additional 27 percent in 1987, to anywhere from $1.1 to $1.5 billion in sales. These estimates may be far too low, however. Globally, the market could exceed $10 billion by 1993, although there are some far more conservative estimates. Due to competition and an expanding market, the cost of TEMPEST equipment is being reduced.[89]

c. Biometric Systems. Biometric systems measure the physical characteristics of the user to determine whether that individual is authorized. Rather than rely on personal identification numbers (PINs), algorithmic keys, ID badges, or passwords, biometric security systems identify users based upon voice, fingerprint, hand geometry (i.e., finger length, palm dimensions and skin translucency), or retinal pattern.

The drawback of these systems is that authorized users may be denied access (viz., false negatives) or that unauthorized users may be granted access (viz., false positives). Their effectiveness depends upon their error rates, balancing the value of security against the number of false negatives. If a system is programmed to reject access if biometric data does not match perfectly, a much larger number of authorized users will be denied access.

Biometric systems vary widely in error rates, cost and effectiveness.

In fingerprint systems, for example, the number of false negatives has been as low as one per 1,000, while the number of false positives has been as low as one per million. In retinal scanning systems, the user must place his or her eye up to a small opening. The retinal scanner uses a light-emitting diode to read the pattern of capillaries on the interior of the eye. Since the error rates for these systems are less than one per million for both false negatives and positives, they are appropriate for circumstances demanding extreme security. The major drawback to retinal scanning systems, aside from cost, is the user's often great fear of exposing his or her eye to a light beam of unknown nature and intensity. Research is being conducted in measuring hand topography, vein patterns of the wrist, typing rhythms, even the lipids and acids found in perspiration.

Biometric security systems provide a number of benefits. There is no threat that a password, key or badge may be lost, stolen or otherwise compromised. Authorized users need not remember an intricate PIN, password or code. In addition, these systems are all designed to provide user audit trails automatically. According to a report from the Business Communications Company, the U.S. market value of all biometric systems for computer security was $4.4 million in 1986. By 1991, the market value should grow to $24.2 million, representing an annual growth rate of 41 percent.[96]

Data Integrity. In the commercial world, it is often impracticable, if not impossible, to control or restrict access to the network. Once an individual gains access to the network, the critical concern is preserving or guaranteeing the integrity of existing and new data. For these purposes, telephone call-back systems can verify both sender and data; and authentication codes and encryption, two processes involving the algorithmic scrambling and descrambling of words and numbers, allow the detection of false or tampered information. In addition, access to data may be controlled through the continuous transmission of meaningless coded messages and many of the same methods used to restrict network access, such as biometric security systems.

a. Call-Back Systems. The most common entry point to a system is the telephone link between a mainframe and a remote user. A potential intruder can access a system by entering the telephone network, locating a signal indicating the presence of a modem, then deducing the code by trial and error. Callback systems mask the telltale signal of a modem. The user dials the modem, enters his password. The connection is cut, and the system then calls him back on an authorized line. Because they require considerable knowledge of central office operations and access is possible only from both ends of the connection, callback systems seem to be highly effective in deterring outsiders from obtaining access.[97]

b. Authentication. Data transmitted with an authentication system remains in cleartext. A field of encrypted text containing the same or equivalent information is transmitted along with the message.

The message authentication code (MAC) or authentication field verifies the message, the sender, and the receptor's authorization. Any variation between the cleartext message and the authentication field indicates a security break or an error. Unlike full encryption systems, the receptor could begin to act on the message while the sender retransmits the message; the retransmission would validate the data. These systems are used when the messages could be seen by an intruder without jeopardizing an activity, customer or organization.[92] The U.S. Department of the Treasury and SWIFT both use authentication systems.

c. Encryption. Any digital message can be scrambled through encryption with a "key," or digital code. An encrypted message cannot be decoded without access to the correct key. The signals transmitted from an ATM to a bank's mainframe computer are encrypted. Unlike authentication, encryption prevents both inside and outside security threats by scrambling an entire message. It is the encoding and decoding of data through an algorithm to render it unintelligible to other than authorized users.[93] However, it is possible that an outsider could still find the links in a network where the data is not encrypted but in cleartext, thus defeating the system. These systems, which may be software or hardware, also ensure that messages are not altered. Unlike authentication, any error will virtually destroy the entire message in the decryption process.[94] The encryption method developed by the National Bureau of Standards, in consultation with the National Security Agency, will be necessary for all banks dealing with the U.S. Treasury.[95]

d. Signature Verification. A variation of biometric security methods is identification based on signature dynamics, i.e., the speed, pressure and form of a signature. Unlike other biometric security systems, such as retinal scanning, signature verification is readily accepted by both consumers and financial institutions. There are four known major developers of signature verification systems.[96] With respect to EFT, prototypes of these systems have been used principally with POS terminals. While error rates are relatively high (one percent for false negatives, and more than three percent for false positives), costs are quite low.[97]

Critical Industry Developments

Federal Communications Commission Actions

The FCC has the responsibility of overseeing much of the implementation of the U.S. Government's telecommunications policies.[98] The electronic financial services industries depend upon a broad range of communications technologies to link widely dispersed facilities and institutions, as discussed above. Thus, the FCC's activities have critical implications for the development and success of EFT.

Enhanced Service Provider Access Charges. In July 1987, the FCC proposed to eliminate the interstate access charge exemption for enhanced service providers (ESPs).[99] ESPs include credit authorization systems, POS systems, and a number of home banking systems, such as Mellon Bank's Telecash. Under the exemption, ESPs are required to pay only flat-rate local business line rates. Elimination of the exemption would have meant that ESPs would be subject to usage-sensitive (i.e., per minute) costs.

The Electronic Funds Transfer Association (EFTA) maintained that the FCC's proposal would have resulted in a $4.50-5.70 per hour increase in access charges for these services. Bankers estimated that access charges could have cost the electronic banking industry almost $250 million per year.[100] These increases would have been passed on to consumers in the form of higher transaction fees. The result, EFTA argued, would have been increased consumer costs, reduced usage of dial-up services, and increased losses from credit card fraud.[101] If retailers were to reduce their use of credit authorization services by ten percent, EFTA estimated that credit card losses could increase by 15 to 20 percent.[102]

In the face of strong opposition by on-line information service providers, consumers, and Congress, the FCC abandoned this proposal in April 1988.[103] Some 20,000 letters opposing the proposal were filed with the Commission.[104]

Open Networks. In order to provide equitable and greater access to the public switched network for ESPs, the FCC has instituted a technical requirement, known as "Open Network Architecture" (ONA).[105] Under ONA, the BOCs must unbundle basic network services and make them available to competing ESPs and others on a tariffed basis. Some degree of national standards might be established in order to create efficient interconnection of systems through the network.

While not the subject of an FCC proceeding, it is appropriate to note another on-going development in network capability and capacity: the digitization of the public switched network, leading to Integrated Services Digital Networks (ISDN). Based on fiber optic technology, ISDN will permit the transmission of vast amounts of information, including voice, data, and video, over the same line. Technical standards were tested in 1987, and implementation by some major phone companies will begin by 1989.[106]

Judicial Actions

In 1982, the U.S. Department of Justice concluded eight years of antitrust litigation against AT&T with a negotiated settlement.[107] The divestiture of AT&T under the consent decree and all subsequent modifications have been overseen by Judge Harold H. Greene of the U.S. District Court for the District of Columbia. The consent decree court has emerged as a significant, albeit perhaps inappropriate, policy-maker.

In September 1987, Judge Greene issued a modification order permitting the seven regional Bell Operating Companies (BOCs) to offer very limited information transmission services (i.e., gateways). The BOCs were prohibited, however, from originating or controlling the content of information services provided over these gateways. They could not provide "enhanced services," but were limited to the mere transmission of data.[108]

In March 1988, Judge Greene further modified his order. While the prohibition against data origination continued, the court granted permission to the BOCs to offer electronic mail and voice messaging in order to aid in mass market development of those information services.[109]

Treasury and Local Government Actions

The U.S. Department of the Treasury affects electronic financial services by developing and adopting EFT applications. By doing so, the Treasury generates private sector demand for EFT systems.

As noted above, the Treasury operates the nation's largest ACH, which has been used for the direct deposit of funds to Social Security beneficiaries, Federal retirees and employees. However, the Treasury and local governments are providing a strong impetus to the electronic financial services industry by developing new programs and applications for the existing infrastructure.

Despite its ACH system, the Treasury still writes over 22 million checks per year, which total over $325 billion. To reduce this number, the Treasury recently initiated a program to also pay the Government's vendors electronically. "Vendor Express" is meant to reduce the cost of processing vendor payments: writing a check is estimated to cost 26 cents, whereas the estimated cost of a Vendor Express transfer is three cents. The reduced check processing costs are expected to more than offset the eliminated float. The value of the EFT program is so great that the Treasury plans to completely eliminate checks within four years.[110]

The importance of Vendor Express is that by establishing the program, the Treasury has created an immediate demand for advanced EFT equipment. At present, many banks have the ability to receive the payments, but cannot receive the information the Treasury will transmit regarding the materials or services being paid. Businesses will insist that their banks have both the ability to receive the payments and the invoice messages accompanying them. Banks lacking these abilities will be forced to upgrade their EFT systems. Once this infrastructure is in place, banks will have every reason to encourage the private sector to use it.[111]

In June 1987, the first local EFT public benefit distribution system was installed and began operations. In Ramsey County (St. Paul), Minnesota, welfare and other public benefit payments, such as the Aid to Families with Dependent Children program, are being distributed to about 10,000 recipients through a modified ATM network.[112] While not operated by the U.S. Government, the Ramsey County system could represent the beginning of a nation-wide distribution system for government benefits.[113] New York City has been evaluating the Ramsey County system for use in distributing welfare payments to some 500,000 recipients.[114] Banks would also benefit from such electronic distribution systems, which would use the existing infrastructure and increase transaction volume.

Risks and Security

Given the velocity, volume and size of electronic financial transactions, and the extent to which public and private communications networks are relied upon, there are tremendous risks involved in this industry. It was revealed that of the $100 billion lost annually in financial transactions, 83 percent is lost through EFTs.[115]

Systemic Risks. The nature of the following examples indicates the extent of the risks involved in reliance upon EFT systems. The critical need for reliable back-up and "disaster recovery" systems is shown clearly.[116]

For two days in November 1985, the Bank of New York experienced a failure in its computerized government securities division. The bank has a fairly heavy volume in government securities, making and receiving payments almost instantly. Due to a software problem, the bank was liable for payments without receipt of corresponding credits. The result was a brief $32 billion overdraft at the Federal Reserve Bank of New York. Interest charges alone cost the bank $5 million, some five percent of its annual earnings.[117]

On May 8, 1988, in Hinsdale, Illinois, a fire in an Illinois Bell automated central office resulted in the disruption of telephone service for 35,000 customers in six Western Chicago suburbs for a number of weeks. Among the businesses most affected were banks and other financial service providers. The banks could not process their regular EFTs to the Federal Reserve Bank of Chicago. In response, the Bank sent unmarked cars to secret pick-up points, where millions of dollars were handed over to Bank officials in bags.

On October 20, 1987, the day after "Black Monday," discussed in detail below, the FedWire system was inoperative for nearly two hours. FedWire, which is relied upon by the Federal Reserve and major banks as the means to conduct EFTs, was plagued by excessive volume and heavily delayed between 10:00 A.M. and 12:30 P.M., according to The Presidential Task Force on Market Mechanisms (or "Brady Commission").[118] However, no major problems resulted from the shut-down, due to its relatively early hours, according to Federal Reserve bankers in New York and Chicago.[119]

Reliance on computers also presents the risk of market disruption from such simple causes as a power failure. On December 9, 1987, the National Association of Securities Dealers Automatic Quotation system (NASDAQ), which provides current market information on over-the-counter stocks, shut down for three hours during morning trading. NASDAQ's main computer in Trumbull, Connecticut went down at 10:43 A.M. from a power outage. Full service, including current price and volume information, was not restored until 2:30 P.M. through the system's back-up computer in Rockville, Maryland. Fortunately, OTC volume was slow and only small backlogs of orders developed.[120]

Electronic financial transactions may be temporarily impossible to conduct because the data stored on an ATM card is lost. For over three years, banks in California have warned customers not to store ATM cards in eelskin wallets and purses. It appears that metallic residue from the tanning process could be demagnetizing the stripe on the cards' reverse. However, exposure to magnetic fields from such common devices as microwave ovens and garage door openers may also destroy the data.[121]

The examples above indicate the dangers inherent in reliance upon advanced data processing and communications technologies. These technologies magnify the consequences of any system error or failure. The speed and volume of transactions create the possibility of an unstoppable financial disaster, beyond the control of either business or government.

Theft and Abuse. In addition to human and system error, the problems of theft and fraud are magnified in an electronic payment system. There are dramatic examples of the magnitude of crime possible through advanced data processing and communications technologies. It is important to note, however, that EFT systems also generally include sophisticated audit trail features, which have permitted the apprehension of criminals and the recovery of misappropriated or stolen funds.

In 1979, a computer consultant charged with stealing $10.2 million through fraudulent wire transfers was arrested while on bail for attempting to steal up to $50 million more from another bank.[122]

Beginning in 1984, Volkswagen AG of West Germany suffered up to $259 million in foreign exchange losses due to unauthorized trades by its inside currency traders and programmers. Fraudulent currency futures contracts were created through a set of forged transactions, and the trades were conducted through the National Bank of Hungary. The fraud was covered up by erased and altered computerized accounting records, and was not discovered until March 1987.[123]

In 1988, two bank clerks and five others were charged with attempting to embezzle $69.7 million from the First National Bank of Chicago. The clerks provided their co-conspirators with instructions on overcoming bank security procedures, and arranged falsely authorized wire transfers from a number of corporate accounts to accounts at Chase Manhattan Bank and two banks in Vienna, Austria, through Citicorp in New York City.[124]

The costs of any system penetration are significant. Tampering with systems and data costs the owners an average of $93,600 per incident. Program or data theft costs an average of $55,166 per incident.[125]

While 47 states have statutes against data theft and tampering, only 75 cases have been prosecuted since 1979. Furthermore, over 80 percent of the computer crimes were committed by insiders. Financial institutions are particularly unwilling to call attention to their problems; they prefer to fire the responsible employees rather than prosecute them. Evidently, there is a need to develop a strong sense of "computer ethics," which will guide people in their use of data processing and communications technologies.

Apart from theft and fraud through electronic payment systems, the prevalence of ATMs as 24-hour sources of cash creates new potential for the commission of violent crime. According to a study sponsored by the Bank Administration Institute, the relationship between ATMs and violent crime seemingly is not as significant as is commonly assumed: only one crime is reported per 3.6 million transactions. Crimes are generally committed between 7:00 P.M. and midnight, in highly visible, non-lobby areas, and ATM cards are rarely stolen during the robbery.[126] Apparently, most criminals are not using ATM cards to gain or attempt access to the network.

Personal Privacy. The computerization of an individual's financial records and the establishment of data bases for credit reporting and verification poses tremendous risks to personal privacy. Credit reporting may rely not only upon current bank balances, but upon an individual's entire economic history: account records; loan and mortgages obtained; payments; purchasing patterns. Increasing use of interactive systems provide ever greater opportunities for the collection of data. Social Security numbers, which identify income records, college and loan applications, Federal and state tax returns, withholding accounts, and (in many states) drivers' licenses, provide a convenient means to access and corrolate a wide variety of information. Public records regarding lawsuits, police reports, bankruptcies, tax liens, property disputes, arrests and convictions, and divorces may also be investigated. In short, the existence of almost any financial transaction or relationship may be discovered, chronicled and reported to any interested party.

One possible method of increasing personal privacy in the Information Age is the development and implementation of "public key" cryptographic systems. Conventional cryptographic systems require the exchange of identical keys between senders and receivers. In public key systems, the encryption key is built into the system, and receivers maintain secret decryption keys. Senders "sign" messages with unreproduceable digital signatures, which can be readily recognized by a receiver. When senders and receivers match halves of two-part keys, decryption occurs and messages are available in cleartext. Using "digital pseudonyms" as substitutes for Social Security and driver's license numbers, and other personal identifiers, the collection of vast amounts of information about individuals and the development of dossiers can be prevented, while financial transactions and credit verification can still continue.[127]

"Black Monday". At no time did the risk of linking computers with telecommunications networks become more apparent than on so-called "Black Monday," October 19, 1987, with the collapse of the New York Stock Exchange. On that day, the Dow Jones industrial average plunged 508 points and lost 25 percent of its value. While analysts have no specific reason for the collapse, a number of contributing reasons are directly related to the computerization of trading: program trading, including portfolio insurance and index arbitrage; the interdependence of global markets and the role of foreign investors; and the operational capacity of the markets.[128]

There are indications that program trading had a negative impact on stock prices. On Black Monday, the panic selling of stocks on the New York Stock Exchange set off computers programmed to respond to such events. Portfolio insurers flooded the Chicago Mercantile Exchange with orders to sell stock index futures. At the opening, futures on the CME fell 20 points below the Standard & Poor's 500-stock Index. Index arbitrageurs detected the divergence detween stocks and futures, and also sent massive orders. Index arbitrage is estimated to have accounted for nine to ten percent of the total sales volume on the NYSE on Black Monday. Futures prices continued falling, bringing down stock prices. Both markets continued spiralling downward as computers placed orders, causing other computers to place other orders. Due to the unprecedented volume of trading, the price quotes from the NYSE began to lag up to two hours behind real-time stock prices. Futures prices on the CME remained current, however, forcing portfolio insurers to rely only on their experience and judgment. The divergence between stock and futures prices grew to as much as 28 points during the day. However, despite their reluctance to continue an almost blind sell-off of their futures, and absorb the increased costs of the "insurance," portfolio insurers still accounted for 24 percent of the total volume on the CME. Without the union of computers and communications networks, program trading would not have had such a profound effect on the markets. In fact, such trading would not even have been possible.[129]

Black Monday also illustrated the global interdependence of equities markets. Markets in London, New York and Tokyo each influenced the other as the activity in one market affected stock prices at opening in another market. While the markets in New York and Chicago reeled under the declining prices and terrific volume, investors in major markets such as London and Tokyo apparently were monitoring, responding and contributing to the downward spiral in the United States. As soon as their own markets opened, the crisis in the U.S. markets was reflected in trading; the downward spiral quickly expanded to a global level as declining prices spread. While it is obvious that there is global interdependence of markets, its full impact on trading within U.S. markets is unknown.

Japanese Developments

Japanese banks are now clearly the world's largest in terms of total deposits. Yet, U.S. banks have remained more profitable, largely as a result of electronic cash management and other financial services. The Japanese, in response, have been acquiring U.S. cash management systems, electronic infrastructure, and expertise. They have been deregulating their internal markets. In addition, the Japanese people appear to be far more receptive to new EFT technologies than people in the United States.[130]

There are more ATMs in Japan than in any other nation on Earth.[131] The world's largest ATM networks are located in Japan, including six of the ten largest proprietary networks.[132] With a population of 120 million citizens, over 135 million ATM cards have been issued.[133] Since the end of 1985, the number of installed ATMs in Japan has increased by 27 percent, versus only eight percent in the United States.[134]

On March 1, 1988, 77 participating banks agreed to link Japan's two largest ATM networks. Within two years, 72 percent of Japan's ATM cardholders will be able to access the new system.[135] While foreign banks are not direct participants in the networks, Citibank linked its 12 ATMs with Dai-Ichi Kangyo's network in early 1988.[136] The agreement represents a significant step towards the integration of EFT systems in Japan.

The integration of all ATM networks in Japan would be far less costly or complicated than such integration in the United States. Japan has only 13 ATM networks, while the United States has 609.[137] Thus, there is much greater diversity in technical industry standards which would have to be accomodated in the United States. Furthermore, all 13 ATM networks' switching facilities are located in the same building in Tokyo.[138] Interconnections would be far easier than among the widely dispersed facilities in the United States.

Integration of Japan's EFT networks has been hindered by government regulation. However, Japan has begun to deregulate its banking and telecommunications industries, which is resulting in a number of benefits. The Ministry of Finance has attempted to maintain equal footing for large and small institutions, and for the postal savings system. Until recently, the Ministry required permission for the installation of each ATM, which was considered to be a bank office. Registration is now sufficient. In addition, in 1985, the Ministry of Posts and Telecommunications ended its restriction on line usage by computer networks.[139] The Finance Ministry now appears to be encouraging the unification of Japan's EFT systems.

The Finance Ministry plans to submit legislation on EFTs before the Diet (Parliament) in December 1988. The legislation, which addresses consumer protection issues and the respective rights and liabilities in EFTs, is under study by the Financial Systems Research Council's electronic banking subcommittee. The legislation is the result of the subcommittee's June 9, 1988 report calling for an update of Japan's EFT laws.[140]

European Developments

The European Community (EC)[141] is now in the process of creating an integrated, internal European market. Under the Single European Act, which was adopted in February 1986, its twelve member nations hope to break down all trade barriers between them by 1992. This includes separate tax systems, regulations, and technical standards.[142] Electronic financial services could be seriously affected.

There has been some discussion of a pan-European bank-owned network which would involve a standard EFT format.[143]

In 1987, 40 banks from 17 European nations signed an agreement to integrate all of their credit and debit card systems within two years. Nonbanks and non-European financial institutions are apparently excluded.[144] Thus, some integration in the European market has already begun.

The danger of the EC's unification plan is the possible erection of protectionist barriers around the new European market, which would insulate it from global competition. In response to this threat, U.S. officials have warned against the creation of a "protective curtain."[145]

Major Trends and Issues

"Information Gateways"

Since Judge Harold Greene issued his order permitting telephone companies to provide information transmission services, a number of BOCs have initiated the development of videotex-based "information gateways" throughout the country. These gateways allow consumers to access a number of information services by dialing a single access number.

The gateways are both an opportunity and a threat to banks. Financial institutions will have new opportunities to offer home banking and other services through the public switched network. There will be more options for banks considering the installation of in-house communications systems. A greater range of options for consumers to communicate with financial institutions should be available. With new competition, prices should be lowered. Home banking at last may become a viable service. However, there is some concern among bankers that the BOCs will develop into financial service providers, and compete heavily with banks.[146]

Bell Communications Research (Bellcore) has begun research on development of the gateways. Bellcore is attempting to establish a minimal set of standards in order to encourage mass service, i.e., generic requirements for network switching and transmission equipment. Uniform interfaces are an essential element of the gateways. Bellcore will examine potential access numbering plans; interexchange access; and terminals protocols like NAPLPS, which is used by Prodigy.[147]

Electronic Data Interchange

Electronic data interchange (EDI) is a means for one corporation to send business data from its computer to another corporation's computer, from buyer to seller. The data is transmitted in a standard, public format. A value-added network, EDI permits the transmission of specially formatted documents -- like purchase orders, price quotes, invoices and shipping advices -- with increased speed, efficiency, and at lower cost. It translates data from format to format, and provides message storage and retrieval functions.[148]

In a sense, EFT itself is a form of EDI, using standard formats developed by the Federal Reserve, National Automated Clearing House Association (NACHA), and the American National Standards Institute's (ANSI) Accredited Standards Committee X12. The new element is the transmission of business data with EFT.

Present EDI volume is low. However, in 1987, third-party providers of EDI were estimated to have earned revenues of $55 million.[149] These revenues are predicted to increase 60 percent annually through 1990.[150] As corporations increase their electronic communications with banks, the volume of EDI should also continue to grow.[151] In a recently released study, the market for all EDI-related products and services is predicted to triple in the next three years. This study valued the 1987 EDI market at $100 million.[152]

Financial institutions, which have made substantial capital investments in data processing and communications hardware and software, wish to continue to expand the range of services available to business consumers through those facilities. National Data Corporation is now developing a full-scale EDI system called "NEDX" (or National Electronic Data Exchange), based on "NETS," an in-house EFT and data processing system now installed in thirteen banks and shared by another hundred.[153] Banks also fear that without EDI capability, business consumers will build private networks, or that competitors will fill this need and may threaten the banks' EFT monopoly itself.[154] Only the largest banks have the resources to build value-added networks for EDI, however.[155]

Businesses are pressuring their banks to accomodate multiple formats and both payment and invoice data. This is due, in large part, to divergent formats used by Treasury's Vendor Express ACH and General Motors' EFT systems (viz., NACHA's cash concentration and disbursement format with invoice addendum record, or "CCD+," and ANSI's payment/remittance advice transaction set, or "X12-820," respectively). Corporations plan to rely on banks for translation capabilities, at least until a standard EFT format is adopted in three to five years.[156]

Competition

Financial institutions in the United States are going to face vastly greater competition in the provision of EFTs and other electronic financial services during the next decade. This competition will include both domestic and international markets.

In order to remain competitive, U.S. banks will have to continue to invest in EFT systems. The seven largest U.S. banks each spend some $200 million per year on information technology.[157] By 1990, following current trends, these banks will spend a total of $6.5 billion on electronic banking systems in 1990.[158] Foreign banks, like the Royal Bank of Canada and Barclays, are investing significant sums in electronic banking systems.[159] The continued development of, investment in, and use of electronic systems will be essential for the survival of financial institutions.

As developments in the telecommunications field indicate, banks will have to deal with the BOCs' information gateways and with EDI, which, offered by nonbanks, could threaten the banks' traditional monopoly on payments.[160]

With respect to international markets, the increasing internal integration of European and Japanese banking markets, while offering the potential of increased efficiency and accessibility, also could result in the greater exclusion of U.S. financial institutions from these markets. The process of establishing technical standards for EFT system interoperability may be subject to protectionist influences.

Electronic Money

Electronic banking is radically altering the global and domestic economies, increasing the speed of financial transactions and investment decisions, even forcing economists to rethink the definition of money itself. Using computers linked by satellite, loans can be applied for, approved, paid and repaid within a fraction of a day. In the course of a typical business day, a bank might transfer funds in excess of three or four times its total deposits.[161] Thus, money is emerging as a dynamic flow or process to be measured by velocity, challenging the accepted regulatory structures and norms which categorize money as a static inventory to be accounted for at the end of the business day. In the transition from tangible, relatively stable cash and paper payment systems, electronic banking makes money volatile and mobile, creating new opportunities for the investment and use of capital while straining government's ability to control its use and flow.

In essence, the development and spread of electronic banking represents the transition from a cash-based payment system to an electronic one. Estimates of transaction volume and current growth trends (viz., two percent growth for paper transactions[162] and ten percent for electronic transactions) indicate that electronic payment systems will not begin to displace paper-based systems until 1998, when paper-based transaction volume peaks. Based upon these estimates, electronic transaction volume will not surpass paper-based transaction volume until 2015.[163] Cash transactions will continue to be the dominant payment system in terms of volume.[164]

Inefficiencies in the current paper system allow consumers to benefit from float, and checks and bank credit cards similarly permit consumers to benefit from short-term loans at the expense of cash-paying consumers and debit card users.[165] Cash and debit card users subsidize credit card users by paying for products at costs inflated to compensate for the merchants' transaction costs. It can be expected that greater pricing incentives (or disincentives) will be provided to consumers in order to increase usage of existing electronic payment systems.[166]

Despite the radical changes resulting from electronic banking, the futurists' vision of a cashless, checkless society remains distant. If that vision is to be realized, then telecommunications will prove to be the essential element. Only by ensuring universal access to electronic banking networks and financial services can electronic money become a reality. Electronic payment systems cannot supplant paper based systems in the absence of access for all citizens.[163] For now, a combination of payment systems exists, and it is unlikely that any one system will supplant the others by the end of the century.

During this transitional phase, the necessity for a mix of payment systems has emerged: financial institutions and corporate users depend upon EFT to conduct business quickly and efficiently, and use it widely for large-value transactions; consumers and small businesses rely upon cash and paper for their small value transactions. Because electronic money must become universally accepted and accessible to the consumer before it can fully supplant cash and paper, and because of the high front-end costs of providing such access, it is more likely that some combination of current payment systems will continue.

Conclusion

In contrast to the traditional payment systems of bartering, cash and checks, electronic banking -- the electronic delivery of financial products and services -- is an infant industry. Yet, in less than forty years, new computer and communications technologies are exercising a profound influence on the financial services industry. Many activities could not be pursued as efficiently without them, such as the sale of government securities or trading on any major market exchange.

The continued rapid expansion of electronic banking and related activities has major implications for the telecommunications industry in general. Such expansion represents substantial new demand for private lines, satellite transponders, fiber optic capacity, and equipment. More importantly, it increases the need to establish technical standards for interchange so that Open Network Architecture and the Integrated Services Digital Network become reality. The more the financial institutions' or BOCs' electronic infrastructure is an open, shared utility, the lower operating costs become and the greater the consumer's access.[164]

Due to the critical role of banking in the creation and distribution of capital in society, financial services will probably never be totally deregulated. Nevertheless, reliance on competition and less regulated or unregulated marketplace forces has contributed to the growth of new electronic financial services and improved efficiency in this key sector. It has tended to ensure that users have available the service and equipment options they need to piece together and operate electronic banking systems. Users have had the opportunity to exploit and capture the efficiencies inherent in new computer and communications technologies to a greater degree than in some other countries where the opportunity to benefit from high technology developments is dependent on the willingness and efficiency of Government-controlled structures.

For society, the computerization of banking and financial services and their link to communications technologies means many things. For consumers, it means lower cost, increased returns, greater convenience and access to funds, and the ability to postpone payment until bills are actually due. For retailers, it means guaranteed payment or greatly reduced risks, rapid collection of accounts receivable, and more efficient inventory control. For financial institutions, it means the ability to participate in more investment opportunities, improve efficiency, reduce transaction costs, and earn greater returns.

In the banking and financial services sector's strong embrace of, and reliance upon, data processing and telecommunications technologies, we recognize the existence of new and serious risks. There are great costs incurred in the acquisition of computers and communications equipment, the infrastructure needed to conduct business in the Information Age. There are failures in the EFT systems and in security; funds may be stolen, altered, misdirected, or simply disappear. Major market exchanges have become so volatile, and changes occur so quickly, that markets may plunge or financial institutions fail before government or business can take any meaningful action. Not least, there are dangers to personal privacy in the accumulation of vast amounts of financial information in private and Government data bases.

With all of its benefits, and all of its risks, electronic banking is clearly an essential element of today's interdependent economy. The probability of economic collapse may not be any greater, but the consequences of any failure could be magnified greatly by the web of computers and communications systems already established by the world's leading financial institutions.

Notes

1. Datamation, Sept. 1, 1987, pp. 46-48. According to the Federal Deposit Insurance Corporation's industry-wide profitability report, "other operating expense" for banks, which includes computers and information systems, rose from $20 billion in 1982 to $28.3 billion in 1985, an increase of 41.5 percent. American Banker, March 27, 1987.

2. EFTS Industry Report, June 1987, pp. 1, 6-9 [source: McKinsey & Co.]; 1987 U.S. Industrial Outlook, p. 48-4.

3. The company has formed a subsidiary, Merrill Lynch Teleport Technologies, to develop and provide alternative local service, either alone or as joint ventures. Merrill Lynch currently owns some 97 percent of Teleport Communications, a New York metropolitan area network, in partnership with Western Union. Communications Daily, Dec. 22, 1987, pp. 2-3. It is also a 2.5 percent partner in International Digital Communications, Inc., a Japanese-British-U.S. overseas consortium which plans to provide transPacific service to Japan via undersea fiber optic cable. Telecommunications Reports, Dec. 7, 1987, pp. 4-5.

4. Coopers & Lybrand, The Future of Technology in the Financial Services Industry (Washington, DC: 1986). Forty-six percent of the respondents still indicated their intention to invest in new technology in order to obtain an advantage over their competition.

5. But see American Banker, March 27, 1987, p. 7 [electronic funds transfer (EFT) systems and automation have failed to meet bankers' expectations of reducing operating costs and personnel, and of eliminating paper transactions].

6. See, e.g., American Banker, May 24, 1988, p. 11.

7. See, e.g., Atlanta Business Chronicle, Jan. 25, 1988, sect. 2, p. 108 [intermediary in AVAIL ATM network].

8. But see American Banker, July 7, 1988, p. 7. In two recent surveys, significant negative attitudes toward electronic banking services were revealed among middle and upper-middle class consumers. In a survey of men's opinions, sponsored by Gentlemen's Quarterly, 22 percent said they would never use an ATM. In another survey, only 16 percent of those surveyed, so-called "technicals," embraced new technologies, and expressed a preference for a cashless, EFT-based society. In each case, higher income and educational levels were associated with more positive attitudes toward electronic banking. See also Network World, July 4, 1988, p. 21.

9. Communications Week, Nov. 23, 1987, pp. 34-35.

10. American Banker, March 27, 1987, p. 7.

11. See, e.g., Washington Post, Nov. 1, 1987, pp. H1, H4.

12. Euromoney, Jan. 1985, p. 56.

13. See U.S. Congress, Office of Technology Assessment, International Competition in Services, OTA-ITE-328 (Washington, DC: U.S. Government Printing Office, July 1987), pp. 91-93. See also Frankel, A. & Marquardt, J., "International Payments and EFT Links," Electronic Funds Transfers and Payments: The Public Policy Issues (ed. E. Solomon, Boston, MA: Kluwer-Nijhoff Publishing, 1987), pp. 111-130.

14. American Banker, March 11, 1987, p. 8.

15. Washington Post, Nov. 1, 1987, p. H4.

16. U.S. Congress, Office of Technology Assessment, Effects of Information Technology on Financial Services Systems (Washington, DC: U.S. Government Printing Office, Sept. 1984), p. 97.

17. Henderson, P., "Modern Money," Electronic Funds Transfers and Payments: the Public Policy Issues (ed. E. Solomon, Boston, MA: Kluwer-Nijhoff Publishing, 1987), pp. 21-22.

18. Newsweek, Aug. 14, 1987, pp. 36-37.

19. American Banker, July 22, 1988, p. 1 [source: The Nilson Report].

20. Association of Reserve City Bankers, Report on the Payments System (Washington, DC: 1982), p. 11.

21. EFTS Industry Report, March 1985, p. 9.

22. Computerworld, March 9, 1987, p. 75.

23. U.S. Congress, Office of Technology Assessment, Effects of Information Technology on Financial Services Systems (Washington, DC: U.S. Government Printing Office, Sept. 1984), p. 19.

24. Wall Street Journal, Aug. 24, 1987. See also EFT Today, June 1988, p. 8 [source: National Automated Clearing House Association (NACHA)].

25. Id.

26. American Banker, March 27, 1987; ABA Banking Journal, May 1987, p. 70.

27. *EFT Today*, June 1988, p. 8 [source: NACHA].

28. *Id.*

29. *American Banker*, May 4, 1988, p. 6; *see also United States Banker*, May 1988, p. 80.

30. *American Banker*, July 22, 1988, p. 1 [source: The Nilson Report].

31. *1988 U.S. Industrial Outlook*, p. 52-4; *but see*, *The Magazine of Bank Administration*, May 1988, p. 23 [net installed base includes 1987 shipments with replacement factor of 27 percent]. The Nilson Report estimates that under 64,000 ATMs were installed in the United States by the end of 1987. *American Banker*, July 22, 1988, p. 1.

32. *The Magazine of Bank Administration*, May 1988, p. 23.

33. *American Banker*, July 22, 1988, p. 1 [source: The Nilson Report].

34. *American Banker*, March 27, 1987, p. 7; *EFT Today*, July 1988, p. 11.

35. *Unites States Banker*, May 1987, p. 14-15; *see also 1988 Bank Network News EFT Network Data Book*.

36. *Id.*

37. *EFT Today*, July 1988, p. 12.

38. *Id.*

39. *American Banker*, July 22, 1988, p. 1 [source: The Nilson Report].

40. *EFTS Industry Report*, May 1987, p. 10.

41. *EFT Today*, June 1988, p. 8 [source: *1988 Bank Network News EFT Network Data Book*].

42. *EFTS Industry Report*, May 1987, p. 10.

43. *American Banker*, July 22, 1988, p. 1 [source: The Nilson Report].

44. *Id.*

45. *American Banker*, July 11, 1988, p. 2. Mac has been aggressively acquiring smaller ATM networks in the Northeast.

46. *Wall Street Journal*, Aug. 20, 1987.

47. Network World, Aug. 31, 1987, pp. 15, 41.

48. This represents an increase of one-half percent since 1985. See 15 Journal of Bank Research 210 (Winter 1985).

49. American Banker, March 27, 1987, p. 7.

50. The Magazine of Bank Administration, May 1988, p. 23.

51. EFT Today, July 1988, p. 8 [source: POS Monitor].

52. Id.

53. Id. at p. 3 [source: POS Monitor].

54. EFT Report, Feb. 25, 1987, p. 1 [source: Carmody & Co.].

55. Id.; American Banker, Feb. 25, 1987.

56. Network World, Aug. 31, 1987, p. 41.

57. Id. However, recently published data indicates that Mobil has some 4,000 terminals in 24 states, and that ARCO now has over 600 terminals. EFT Today, July 1988 [source: POS Monitor].

58. EFT Report, Feb. 25, 1987, p. 1.

59. Id.

60. Id.

61. See generally Network World, Aug. 31, 1987, pp. 15, 41.

62. American Banker, Jan. 25, 1988, p. 3; United States Banker, May 1987, p. 14.

63. American Banker, June 22, 1988, p. 14.

64. Id.

65. American Banker, Jan. 25, 1988, p. 3.

66. The Magazine of Bank Administration, June 1988, p. 42.

67. Id.

68. See, e.g., Network News, Aug. 24, 1987, pp. 26-27 [Precision Software's "Home Branch" system].

69. The Magazine of Bank Administration, June 1988, p. 42.

70. 1988 U.S. Industrial Outlook, p. 30-7. This represents a growth of six million PCs over 1987. United States Banker, Feb. 1985, p. 37. See also Electronics Industry Association, "Resurgence in Home Information Market Led by Strong Computer, Telephone Sales" (Washington, DC: March 27, 1987); 1986 U.S. Industrial Outlook, p. 28-4.

71. In 1987, estimates were that only 60,000 Americans were using home banking services. Network World, Aug. 24, 1987, pp. 26-27. This represented an increase of 16,000 users since 1984. See American Banker, Jan. 28, 1985, p. 14.

72. Link Resources Corp., report, May 1988. The number of U.S. households owning both PCs and modems has been steadily growing. See, e.g., Electronics Industry Association, 1987 Electronic Market Data Book, p. 48.

73. Network World, July 4, 1988, p. 21.

74. Id.

75. American Banker, July 15, 1988, p. 16.

76. Network World, July 4, 1988, p. 21.

77. American Banker, July 15, 1988, p. 16.

78. COVIDEA fact sheets, undated.

79. CompuServe Inc., CompuServe Almanac (2d ed. 1986), pp. 91-113.

80. Interactivity Report, April 1988, p. 1.

81. American Banker, June 22, 1988, p. 8.

82. By the end of 1987, there were 3.6 million smart cards issued in France. French banks will be replacing all magnetic tape cards with smart cards in 1988. The Economist, April 30, 1988, p. 74.

83. American Banker, April 20, 1988, p. 2.

84. Id.; The Economist, April 30, 1988, p. 74.

85. Id.

86. See 1987 U.S. Industrial Outlook, p. 48-4.

87. *Computerworld Focus*, June 3, 1987, p. 25.

88. *Network World*, Nov. 16, 1987, pp. 17-18.

89. *Government Executive*, Sept. 1987, pp. 82-85; *see also* *Government Data Systems*, May 1988, p. 10.

90. *See generally* *High Technology*, Feb. 1987, p. 54.

91. *Computerworld Focus*, June 3, 1987, p. 25.

92. *Computerworld*, June 3, 1987, pp. 48, 50; *Network World*, Aug. 24, 1987, p. 33.

93. The National Bureau of Standards established a standard algorithm for the encryption of data (DES) in 1977. A user can obtain a unique result based upon the value, or "key," selected. Keys are often stored on disks, and access to them must be stringently controlled.

94. A message will contain at least 50 percent errors if even one bit has been altered. *Network World*, Aug. 24, 1986, p. 33.

95. *Computerworld Focus*, June 3, 1987, p. 25.

96. Warfel & Miller, Inc., *1988 Biometric Industry Directory*.

97. *See* *High Technology*, Feb. 1987, p. 54; *American Banker*, May 25, 1988, p. 5.

98. *See* 47 U.S.C. 151, 157 (1982).

99. *Amendment of Part 69 of the Commission's Rules Relating to Enhanced Service Providers, Notice of Proposed Rulemaking*, CC Docket No. 87-215, FCC 87-208 (released July 17, 1987).

100. *See* *American Banker*, April 6, 1988, p. 9.

101. Comments of Electronic Funds Transfer Association in CC Docket No. 87-215, filed Sept. 24, 1987. *See also* NTIA Comments in CC Docket No. 87-215, filed Sept. 22, 1987; and NTIA Reply Comments, filed Oct. 26, 1987.

102. *Id.*, at 5.

103. *Final Order*, CC Docket No. 87-215, FCC 88-151 (released April 27, 1988).

104. *See* *Interactivity Report*, April 1988, p. 1; *American Banker*, April 6, 1988, p. 9.

105. *Third Computer Inquiry (Computer III)*, 104 FCC 2d 958 (1986), recon. FCC 88-9 (Phase I) and FCC 88-10 (Phase II) (released Feb. 18, 1988).

106. *1988 U.S. Industrial Outlook*, p. 33-2.

107. *United States v. American Telephone and Telegraph Co.*, 552 F. Supp. 131 (D.D.C. 1982), *aff'd* *sub* *nom.*, *Maryland v. United States*, 460 U.S. 1001 (1983).

108. *See* *United States v. Western Electric Co., Inc.*, 673 F. Supp. 525 (D.D.C. Sept. 10, 1987) [Modification Order].

109. *United States v. Western Electric Co., Inc.*, Civ. No. 82-0192, Slip Op. (D.D.C. March 13, 1988) [Further Modification Order]. *See also* *American Banker*, April 15, 1988, p. 1.

110. *Wall Street Journal*, Aug. 24, 1987.

111. General Motors, which now uses EFT to pay some 1,200 auto parts vendors, ultimately plans to pay all 5,500 of its vendors electronically. This will eliminate the need to write approximately 3.6 million checks per year. *Id.*

112. *American Banker*, July 1, 1987; *United States Banker*, June 1988, p. 9.

113. *See* U.S. Congress, Office of Technology Assessment, *Electronic Delivery of Public Assistance Benefits: Technology Alternatives and Policy Implications* (Washington, DC: U.S. Government Printing Office, May 1988); *see also* *American Banker*, April 11, 1988, p. 9.

114. *Crain's New York Business*, June 13, 1988, p. 2.

115. *1987 U.S. Industrial Outlook*, p. 48-4.

116. *See, e.g.*, *Network World*, June 27, 1988, p. 31; *Network World*, June 20, 1988, p. 2.

117. *Washington Post*, Dec. 13, 1985, pp. D1, D7-D8.

118. *See* Report of The President's Commission on Market Mechanisms (Washington, DC: U.S. Government Printing Office, Jan. 8, 1988).

119. *Pension & Investment Age*, Feb. 22, 1988, p. 29. More significantly, bankers were unwilling to transfer funds due to the Federal Reserve's daylight overdraft or net debit cap policy. They were threatened by the possibility that customers would not be able to cover the transfers by the end of the business day, thus causing banks to exceed overnight lending limits.

120. *Washington Post*, Dec. 10, 1987, p. D2.

121. Los Angeles Times, Feb. 11, 1988, sect. 4, p. 1.

122. Washington Post, Feb. 14, 1979, p. A7.

123. Computerworld, Dec. 14, 1987, p. 73; Computerworld Focus, June 3, 1987, p. 13.

124. The Reuter Business Report, May 18, 1988.

125. Computerworld Focus, June 3, 1987, p. 25 [source: National Center for Computer Crime Data].

126. EFTS Industry Report, May 1987, pp. 1-3.

127. See 89 Technology Review 56 (Aug. 1986).

128. "Studies Aim to Clear Muddy Waters of Stock Market Plunge," Washington Post, Nov. 29, 1987, pp. H1-H3.

129. See Report of The President's Commission on Market Mechanisms [the "Brady Commission"] (Washington, DC: U.S. Government Printing Office, Jan. 8, 1988); Fortune, Feb. 1988, p. 18; "Calculating Computers' Role," Washington Post, Nov. 29, 1987, pp. H1, H4-H5.

130. In the United States, checks are used for 98 percent of all noncash payments. In Japan, checks constitute only 18.7 percent of all noncash payments. Automatic debits and ATM direct payments (from special EFT machines called "furikomi") represent 71 percent of all noncash payments in Japan, versus approximately one percent in the United States. American Banker, March 16, 1988, p. 2 [source: Bank for International Settlements].

131. There are an estimated 80,933 ATMs in Japan, versus 63,865 in the United States. American Banker, July 22, 1988, p. 1 [source: The Nilson Report].

132. Id.

133. Id.

134. Id.

135. American Banker, March 16, 1988, p. 2.

136. Id.

137. American Banker, July 22, 1988, p. 1 [source: The Nilson Report].

138. American Banker, March 16, 1988, p. 2.

139. *Id.*

140. Jiji Press Ticker Service, June 9 and 24, 1988.

141. The EC consists of: Belgium, Denmark, France, Germany (F.R.), Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom.

142. *See, e.g.*, U.S. Department of Commerce, National Bureau of Standards, *A Summary of the New European Community Approach to Standards Development*, NBSIR 88-3793-1 (Springfield, VA: National Technical Information Service, August 1988).

143. *See The Financial Times*, May 26, 1988, p. X.

144. European Accord for Bank Card Usage, *discussed in* Mitchell, J., *Electronic Retail Banking and the Consumer: the European Dimension* (London: Policy Studies Institute, 1988).

145. *Washington Post*, Aug. 5, 1988, p. F3 [address by Deputy Treasury Secretary M. Peter McPherson to Institute for International Economics, Aug. 4, 1988].

146. *See, e.g.*, *American Banker*, April 15, 1988, p. 1.

147. *Communications Daily*, Aug. 2, 1988, p. 3.

148. *See, e.g.*, *Crain's Chicago Business*, June 13, 1988, p. T1.

149. *1988 U.S. Industrial Outlook*, p. 51-2.

150. *Id.*

151. In 1983, 61 percent of U.S. corporations used a terminal to initiate a financial action or make an inquiry of a bank. In 1988, more than 90 percent of U.S. corporations are expected to communicate with their bank via computer. *American Banker*, Jan. 5, 1988, p. 6 [source: Greenwich Associates].

152. *The Magazine of Bank Administration*, April 1988, p. 40 [source: Bank Administration Institute, Coopers & Lybrand, and EDI Strategies, Inc., study].

153. *American Banker*, July 27, 1988, p. 8.

154. *Id.* *See also* *American Banker*, March 30, 1988, p. 6.

155. *See* *American Banker*, March 30, 1988, p. 6.

156. See The Magazine of Bank Administration, April 1988, p. 40.

157. The Financial Times, May 18, 1988, p. VIII [source: McKinsey & Co.].

158. Id.

159. The Royal Bank of Canada plans to invest some $2 billion in the next five years. Maclean's, Feb. 29, 1988, p. 8. Barclays, a British bank, spends about $300 million per year on information technologies. The Financial Times, May 18, 1988, p. VIII.

160. See, e.g., American Banker, April 15, 1988, p. 1.

161. Computerworld, Oct. 29, 1984, pp. 1-2.

162. But see American Demographics, Feb. 1987. In 1985, check volume was increasing by four to five percent annually.

163. Henderson, P., "Modern Money," at 26-27.

164. Id.

165. Two Federal Reserve economists, using 1983 data, found that it costs 68 cents to produce and process a check, but that a consumer will receive 83 cents in float benefits by writing a check, based on delays in clearing and settlement. Thus, the consumer is paid to use checks. See Berger, A. & Humphrey, D., Technological Innovation, Regulation, and the Monetary Economy (ed. C. Lawrence & R. Shay, Cambridge, MA: 1986). In contrast, consumers are often asked to pay for the use of electronic payment methods.

166. On May 26, 1988, Manuel Johnson, Vice Chairman of the Federal Reserve Board, called upon banks to revise their fee schedules to reflect more accurately the actual cost of processing checks and encourage greater use of EFTs. New York Times, May 27, 1988, p. D6.

167. See 47 U.S.C. 151 (1982). See also Pressler, L. & Schieffer, K., "A Proposal for Universal Telecommunications Service," 40 Fed. Comm. L. J. 351 (May 1988).

168. See, e.g., American Banker, March 11, 1987, p. 7.

XI

Commercial Broadcast Television

by Timothy C. Sloan
David Krech

Television is, without question, one of the most influential inventions in the twentieth century. This cliche, however, trivializes television's pervasive impact upon American culture. Ninety-eight percent of the nation's 90 million households have at least one television set,[1] and that is more than have telephones or indoor plumbing. In 1987, the average household watched TV for 7 hours and 5 minutes each day.[2] In its brief history, television, for good or ill, has helped homogenize American society by providing a common cultural frame of reference for Americans of all regions, incomes, and backgrounds.

In the broadest sense, "television" simply refers to the video programming that people view in the comfort of their living rooms. That programming is delivered to the home in a variety of different ways, however, and each constitutes a vital part of the world of television. This section examines one such delivery system -- commercial broadcast television. Broadcast television involves the transmission through the air of radio signals that can be received and translated into words and pictures by a standard television set. It is commonly referred to in this country as "free" television because viewers do not pay a direct charge for the programs they watch. Instead, operating costs are recovered through the sale of advertising time in the programs transmitted.

Broadcast television was the first and, for many years, the only means for delivering pictures to the home. In recent years, however, new technologies have arisen to challenge the dominance of broadcast television as the primary video distribution system. The rise in competition has had a profound effect upon the structure and operation of the broadcast television industry. While commercial broadcasting remains the backbone of the nation's video distribution system, commercial broadcasters' ability to maintain that position in the future hinges upon their success in adapting to the dramatic changes in the television marketplace.

Key Industry Statistics

The commercial broadcast television industry is comprised of individual broadcast stations located throughout the nation. Those stations operate at both very high frequency ("VHF") (TV channels 2-13) and ultra high frequency ("UHF") (TV channels 14-70), and at power levels authorized by the Federal Communications Commission ("FCC"). In August 1988, there were 1,044 commercial television stations operating in the United States, 543 VHF and 501 UHF.[3] Table 1 indicates the growth in stations since 1955[4]

TABLE 1[5]
Growth in Commercial Television Stations

Year	Total	VHF Stations	UHF Stations
1987	982	547	435
1986	922	541	381
1985	904	539	365
1980	746	517	229
1975	711	513	198
1970	690	508	182
1965	586	487	99
1960	517	441	76
1955	411	294	117

Most commercial stations are held by group owners, firms or individuals who own more than one station. As of January 1, 1986, some 180 different entities either completely or partially owned 697 stations, or roughly 73 percent of the commercial stations then on the air.[6] In 1986, 87.9 percent of the VHF stations in the 100 largest television markets were group owned, as compared to 50 percent in 1956.[7] Group ownership of UHF stations in those same markets has also increased, albeit at a slower rate.[8] Table 2 lists the 20 largest group owners at the end of 1987, along with the percentage of television households served by each owner.

Roughly 63 percent of all commercial stations are affiliated with one of the three national programming networks, ABC, CBS, and NBC.[9] Under these affiliation agreements, the networks provide about 70 percent of their affiliates' programming.[10] Network expenditures for that programming have escalated dramatically over the past decade. The cost of a 30 minute prime time situation comedy, for example, increased from $115,000 in 1976 to $410,000 in 1987. The cost of hour long programs more than tripled from $255,000 to $850,000 over the same period, with some shows regularly exceeding $1 million per episode.[11] The networks not only compensate their affiliates for carrying network programs (and accompanying commercials), but also commonly provide slots within network "feeds" where affiliates can insert locally generated commercials.

TABLE 2[12]
Commercial TV Station Group Owners

Owner	No. of Stations	Households Served (%)
Capital Cities/ABC	8	24.4
NBC	7	22.3
CBS	4	19.4
Fox	7	19.4
Tribune Broadcasting	6	18.7
Home Shopping Network	11	14.6
Gillette Group	13	12.3
Chris Craft Industries	7	10.5
Group W	5	10.1
Gannett	10	9.9
Telemundo Group	6	9.2
Cox Enterprises	8	9.0
Spanish International	6	8.9
MCA	1	7.7
TVX Broadcast Group	11	7.6
Scripps Howard	9	7.3
Hearst Broadcasting	6	6.9
RKO	2	5.9
A.H. Belo	5	5.7
Gaylord	5	5.3

While most commercial stations are network affiliates, Table 3 shows the dramatic increase in unaffiliated, or independent, stations in recent years.[13]

TABLE 3[14]
Independent Commercial Television Stations

Year	Unaffiliated Stations		Unaffiliated Stations
1980	112	1984	214
1981	142	1985	248
1982	171	1986	272
1983	197	1987	310-371

Independent stations, as a group, have steadily improved their financial positions, although their businesses continue to be more risky than network affiliates. Unlike affiliates, independent stations must purchase virtually all of their programming in the open market. For the average station, programming costs account for as much as 50 percent of their total operating costs.[15] Independent stations are thus more vulnerable than affiliates to changes in the supply and cost of programming.

Additionally, while most network affiliates occupy VHF channels, the vast majority of independents use UHF frequencies.[16] Operation in the UHF band entails substantial additional costs. Transmission equipment for a full-powered UHF station, for example, is approximately 70 percent more expensive than the equipment for a full-powered VHF station. Further, because a radio signal attenuates more quickly at higher frequencies, a UHF station must transmit at much greater power than a VHF station to obtain comparable geographic coverage.[17] Consequently, electricity costs for a UHF station are typically 30-50 percent higher than for its VHF rivals.

UHF transmissions, moreover, are more susceptible to interference and signal degradation than VHF transmissions. Although this UHF "handicap" has been reduced by improvements in transmission equipment, television receivers, and antennas, or by the carriage of UHF stations by cable television systems,[18] UHF stations still have difficulty matching the signal quality and cost efficiencies of their VHF competitors.

As noted, "free" over-the-air television is funded by the sale of advertising time by networks and local stations. Commercial "spots" for a particular program are sold in 30 or, increasingly, 15-second increments, with the rates based upon the size and demographic characteristics of the audience watching the program. In October 1987, the three networks charged $121,860 for an average 30-second spot in their prime-time schedules (8-11PM each weeknight), an 8 percent increase from the previous October.[19] The most expensive commercial time on television is a 30-second spot during the annual Super Bowl telecast, which cost $675,000 in January 1988, up $75,000 from the previous year.[20] A 30-second commercial during the most popular prime-time program, the "Cosby Show," cost as much as $400,000 in October 1987.[21]

Table 4 depicts television advertising revenues (in billions of dollars) for the last ten years:

TABLE 4[22]
Television Advertising Revenues ($ Billions)

Year	Total	Network	National/ Regional Spot	National Syndication	Local
1987	23.19	8.79	6.84	.73	6.83
1986	22.26	8.57	6.57	.61	6.51
1985	20.54	8.29	6.00	.54	5.71
1984	19.53	8.53	5.49	.43	5.08
1983	16.49	7.02	4.83	.30	4.35
1982	14.49	6.21	4.36	.15	3.77
1981	12.76	5.57	3.75	.08	3.37
1980	11.42	5.13	3.27	.05	2.97
1979	10.15	4.60	2.87	--	2.68
1978	8.96	3.98	2.61	--	2.37

Critical Industry Developments

Several U.S. broadcast stations were experimenting with television as early as 1928, but the first regularly scheduled broadcast programming began in Germany in 1937. Franklin Roosevelt was the first president to appear on television when he opened the New York World's Fair in 1939. That year also marked the first telecast of major league baseball. While interest in television continued to grow through the 1940s, the FCC did not settle on a plan for station assignments and spectrum usage until the next decade. In a decision issued in 1952, the FCC established a table of assignments that distributed some 2,000 television channels among nearly 1,300 communities.[23]

The channel allocation plan embodied in the table of assignments reflected two policy decisions that have profoundly affected the structure of the broadcast television industry. First, the table was designed to promote "localism," the concept that television broadcast stations should be distributed and operated to serve as "outlets for local self-expression." Thus, channels were assigned so that as many communities as economically and technically possible would have at least one station. This meant, however, that fewer channels could be assigned to any particular community.

Second, the table of assignments "intermixed" VHF and UHF channels in more than 200 markets. Because the technical and cost characteristics of UHF broadcasting were inferior to VHF transmissions, for many years UHF stations lagged far behind VHF stations in terms of reception and acceptance by audiences and advertisers. Until the disparity between UHF and VHF broadcasting was reduced, the intermixture of those channels in many markets undoubtedly hindered the growth of UHF television.

One consequence of the policy choices underlying the table of assignments was the growth of a broadcast industry dominated by a few national program networks. As noted, because of the limitations of UHF transmissions, viewers in any given market would gravitate towards VHF channels because of the better reception. Thus, for a new network to succeed, it would need access to VHF stations in a critical mass of markets. Under the table of assignments, a prospective network in 1952 could find VHF stations in 45 of the top 50 markets. A second network entrant could find VHF stations in 43 of the top 50 markets. A third network, however, could access VHF stations in only 27 of the top 50 markets, while a fourth would find VHF stations in just seven.[24] These limitations made it very difficult for more than three program networks to survive. Indeed, it took 25 years for ABC, the third network, to become competitive with CBS and NBC. The fourth, the DuMont Network, made up largely of UHF stations, terminated operations shortly after the FCC's 1952 decision.

Because television channels are limited, the FCC acts as spectrum "traffic cop," granting licenses to operate broadcast stations. In selecting a licensee from among competing applicants, the FCC assesses the technical, financial, and character qualifications of each applicant. To promote localism, the FCC awards comparative preferences to applicants who will live in the community of license. To foster diversity of viewpoints (an important goal in a democratic society), it also considers the media holdings of each applicant. For the same reason, the FCC has limited the number of television stations an entity may hold, and has adopted rules prohibiting newspapers, cable television operators, and radio licensees from owning television stations in the same market.[25]

Once licensed, a television station owner is obligated to operate in the "public interest." As a result, television broadcasters are frequently referred to as "trustees" of the airwaves,[26] holders of a valuable public resource for the benefit of the viewing public. To reinforce broadcasters' trusteeship responsibilities, the FCC has over the years adopted a myriad of regulations governing a licensee's business operations and program content.

Thus, in addition to refraining from questionable business practices (for example, fraudulent billing, transmission of private lottery information), licensees have been required to limit the amount of commercials broadcast, to provide minimum levels of news and public affairs programming, and to conduct periodic surveys to determine the needs and interests of their communities ("ascertainment requirement"). When a station licensee periodically applied for renewal,[27] it had to submit extensive documentation to demonstrate that the station had adequately served the public interest during the preceding license term.

In the past decade, however, the FCC and other experts have questioned the need for such stringent regulation of television licensees. The FCC instead determined that broadcasters will comply with their responsibilities without government prodding, if for no other reason than because it is good business to be responsive to audience demands.[28] Consequently, the FCC has moved aggressively to eliminate many of its television regulations. In 1981, for example, it replaced its cumbersome renewal process with a system of brief "postcard" renewal applications supplemented by random audits of a small percentage of licensees.[29]

In 1982, the FCC eliminated rules that obligated a licensee to hold its license for three years before being able to transfer it.[30] Two years later, it revised the multiple ownership rules to permit an entity to own 12 television stations (the previous limit had been seven), so long as the signals from all of those stations combined do not cover more than 25 percent of the nation's population.[31] During these years, the FCC was also vigorously pruning regulatory "underbrush" by eliminating various more minor technical and operational regulations.[32]

More recently, the FCC has begun to eliminate regulations and policies that affect the programming decisions of television broadcast licensees. In 1984, the FCC relaxed advertising limits, news and public affairs programming requirements and ascertainment obligations for all commercial television licensees.[33] In 1987, it terminated enforcement of the so-called Fairness Doctrine, which required that broadcast licensees address in a fair and balanced manner controversial issues of interest to their communities.[34]

Competitive Developments

Many of the issues and challenges currently facing the commercial broadcast television industry stem from the dramatic changes that have occurred in the television marketplace over the past two decades. At the end of the 1960s, over-the-air broadcasting was virtually the only medium for delivering television pictures to the home. The sole alternative, cable television, was still in its infancy. In January 1969, there were slightly more than 2,200 cable systems in the United States, serving about 3.6 million subscribers, or roughly 6 percent of the nation's television households.[35] The average system, moreover, delivered less than 10 channels of programming,[36] primarily retransmitted broadcast signals.

By 1988, however, broadcasting's market preeminence had diminished substantially. Although the number of commercial television stations increased more than 65 percent between January 1968 and August 1988 (from 635 to 1044),[37] competing media had grown even faster. The number of cable systems, for example, had nearly quadrupled by January 1988, to 8,500.[38] The average system currently offers some 32 channels,[39] fewer than one half of which are broadcast signals. More than 80 percent of the nation's households now have access to cable, and more than half subscribe.

Videocassette recorders ("VCRs") first appeared as consumer products in the mid-1970s. By 1988, more than 58 percent of all television households owned at least one.[40] VCR households spend just under 5 hours each week watching recorded tapes.[41] Although the majority of this time is occupied viewing recorded broadcast or cable programming, nearly two hours each week are consumed by viewing commercially marketed tapes.[42] Indeed, prerecorded videocassette sales and rentals exceed $11 billion annually. The spread of VCRs doubtless explains in part the steady decline in the percentage of homes watching television over the past several years.

While cable television and VCRs are the principal competitors to broadcast television, other distribution media have appeared. Direct broadcast satellite ("DBS") service has finally developed, although not in the form originally envisioned. The FCC authorized DBS in 1982 as a stand-alone service that would deliver programming directly to the home via satellite.[43] The service contemplated never arose, largely because the costs were such that DBS could not compete with other distribution media.

Instead, satellite delivery of programming to the home emerged with the increasing use of satellites by program networks to deliver programming to their local broadcast and cable affiliates. Many households purchased satellite receiving equipment (the costs of which had dropped substantially with the spread of satellite transmission) to intercept signals intended for local broadcast stations and, more commonly, local cable systems. Attempting to stop a perceived theft of service,[44] cable networks began to scramble their signals to prevent interception by home satellite receivers.

In 1984, Congress outlawed unauthorized reception of scrambled satellite signals, but only where the providers had instituted a plan for making such signals available to all customers willing to pay for them.[45] Although there have been recurring complaints about the marketing plans adopted, and the rates charged, more than 2 million households now directly receive satellite programming via this so-called low-power DBS service.

Meanwhile, interest is reviving in the original DBS concept. Tele-Communications Inc., the nations' largest cable company, recently applied to the FCC for a DBS license, proposing to spend $500 million for a two-satellite, 32 channel system to be launched in 1995.[46] Hubbard Broadcasting, a long-standing proponent of DBS, has requested another extension of its existing DBS license, asserting that current market conditions "virtually guarantee" DBS deployment by 1992.[47] Improvements in transmission technology and receiving antennas, coupled with the growth of DBS in Japan and Europe and the introduction of high definition television,[48] may have improved prospects of DBS in the United States. Given DBS' checkered history to date, however, it remains to be seen whether the latest hopes for the service will eventually bear fruit.

In 1979, the FCC established the low power television service ("LPTV").[49] LPTV stations operate on standard VHF and UHF channels at greatly reduced power (10 watts VHF; 1,000 watts UHF). They cost about $500,000 to start and have a range of about 20 miles. Although the FCC originally anticipated about 4,000 stations would be licensed, the application process quickly turned into a regulatory nightmare, with more applications filed than the FCC could hope to process in any reasonable fashion. After numerous delays, the licensing process has only recently begun to untangle.

In part because of processing problems, there were only 388 operational LPTV stations as of August 1988, 282 UHF and 106 VHF.[50] Processing delays do not appear to be the only explanation for the small number of LPTV stations. It may be that LPTV stations are having difficulty creating a niche for themselves in the marketplace. Although the number of UHF stations on the air has more than tripled since the end of 1983, the number of VHF stations has plummeted from a high of 248 in June 1986.

Subscription television ("STV")[51] and the multipoint distribution service ("MDS")[52] appear to be fading after some brief initial success. In 1982, there were 27 STV stations serving about 1.3 million subscribers. By 1985, the number of stations had dwindled to five and the number of subscribers to 166,000.[53] High-tide for MDS also occurred in 1982 when 99 systems were serving 565,000 subscribers. In June of 1985, the numbers were 67 and 364,000, respectively.[54] Those single-channel pay services apparently could not compete once a community was wired for cable television.

To improve MDS' competitive prospects, the FCC established the multichannel MDS ("MMDS") service in 1983, adding two blocks of four channels each (to be assigned by lottery) to the two MDS channels originally set aside for each market.[55] MMDS operators can increase their channel capacity by leasing adjacent frequencies from licensees in the instructional television fixed service (20 channels available per market) and the private operational fixed service (3 channels available per market). By so doing, an MMDS operator could provide as many as 33 channels of programming in a particular community, in effect creating a "wireless" cable television system.

As of July 1988, the FCC had issued 21 MMDS licenses in 19 markets. An additional 189 construction permits had been issued in 148 markets.[56] Few systems are operational, however. The local cable company is providing 14 channels of programming via MMDS in Milwaukee. Another company currently provides 12 channels of programming (not including broadcast signals) to about 20,000 subscribers in Cleveland for $18.95 per month, comparable to the rates charged by many cable systems.[57] Microband, the largest of the original MDS operators, began offering 20 channels of programming for $23.95 per month to the uncabled outer boroughs of New York City in November 1987.[58] It has since begun marketing similar service in Detroit and Washington, D.C.

The growth of MMDS may be restricted by certain technical limitations of MMDS transmission. First, under FCC rules, the maximum power of an MMDS transmitter is 100 watts.[59] As a result, the average MMDS service area has a radius of 25 miles, as compared to the 35-50 mile radius covered by the typical television broadcast station. This, of course, limits the potential market that can be served by each MMDS operator.

Second, MMDS needs a clear line-of-sight path between transmitter and receiver to provide an adequate picture. Thus, MMDS signals are far more susceptible than broadcast signals to interference or blockage by buildings, terrain, or foliage. For this reason, as much as 25 percent of homes in an MMDS systems serving area cannot receive an adequate picture.[60] These technical limitations will likely render MMDS a niche service that is most competitive in areas where cable service is unavailable.

Nonetheless, the long-term viability of MMDS, even as a niche business, will depend in large part on operators' ability to acquire and retain programming that will attract subscribers. There are already complaints, however, that satellite programming networks are refusing to deal with MMDS stations. While a number of satellite services are making their signals available for MMDS retransmission, several of the major services (such as, HBO, ESPN, CNN, and the USA Network) have been less forthcoming.[61] Where satellite networks do deal with MMDS stations, it appears that the rates charged are generally higher than those paid by cable systems.[62] It remains to be seen whether MMDS operators will be able to overcome their difficulties in obtaining sufficient programming to compete effectively with cable as an alternative to commercial broadcast television.

Current Issues

The proliferation of distribution media over the last two decades has transformed the television marketplace. For viewers, it has dramatically increased the range of programming available to the home. At the end of the 1960s, the only viewing option available to most households was broadcast television. Program choices were limited, moreover, because more than three-quarters of all stations were affiliated with the three national networks.[63]

In contrast, by 1988 less than two-thirds of commercial stations were network affiliates.[64] The growing ranks of independent stations offer viewers an array of non-network programming provided by a vibrantly competitive syndication market. Households passed by cable have access to more than 60 national networks containing fare to satisfy the most (or least) discriminating viewer. Finally, for those times when "there's nothing on TV," the millions of homes with VCRs can fill the void from a welter of prerecorded tapes.

These changes have profoundly affected commercial television broadcasting. While broadcast stations have often been referred to as "licenses to print money," growing competition have made the financial benefits of broadcast ownership less automatic. The proliferation of outlets has increased demand for programming, thus contributing to the dramatic escalation in its costs, a major expense for most broadcast stations.

The expansion of outlets has also created alternatives for advertisers. As a result, broadcasters can no longer count on the comfortable, double-digit annual increases in advertising revenues experienced during the 1970s. Buffeted by increased competition, and squeezed by higher programming costs and diminishing advertising revenues, broadcasters must be more cost conscious and more aggressive in differentiating themselves from their broadcast and non-broadcast competitors.

Challenges for the Networks

The transformation of the television industry has particularly affected the three broadcast networks, ABC, CBS, and NBC, simply because, as the dominant forces under the old industry structure, they had the most to lose from that transformation. The impact on the networks is manifold. Since 1985, for example, each of the three networks has changed hands. Capital Cities Broadcasting, owner of seven television stations in major markets, purchased ABC for $3.5 billion. General Electric subsequently acquired RCA and its subsidiary NBC for approximately $6.3 billion. Finally, CBS, after weathering a takeover attempt by cable entrepreneur Ted Turner, came under the control of Laurence Tisch, one of its principal minority stockholders.

The impact is also evident in the long-term decline in the networks' viewership over the past decade. In the late 1970s, about 93 percent of the television audience watched network programming each evening throughout the year.[65] By

1987, the average audience share had declined to 70 percent.[66] Although the networks have managed to arrest the audience decline during the prime time ratings season (September to April),[67] they have been battered during other parts of the day and year. In July 1987, for example, when the networks relied heavily on reruns, the combined network audience was 61 percent, down more than 18 percent from the previous April.[68] Network audience shares in the daytime period (10 AM to 4:30 PM) declined from 77 percent in 1979 to 58 percent in 1987; late night (11:30 PM to 1 AM), shares plunged from 78 percent in 1979 to 53 percent in 1987.[69]

The impact is also apparent from the networks' stagnating advertising revenues over the past several years. Table 5 depicts the changes in network advertising revenues (in billions of dollars) over the past ten years:

TABLE 5[70]

Network Advertising Revenues ($ Billions)

Year	Network	Percent Increase (Decrease)
1987	8.79	2.6
1986	8.57	3.4
1985	8.29	(2.8)
1984	8.53	21.5
1983	7.02	13.0
1982	6.21	11.5
1981	5.57	8.6
1980	5.13	11.5
1979	4.60	15.6
1978	3.98	15.0

The decline in advertising revenues in 1985 was not only the first since Congress banned cigarette commercials in 1971,[71] but came after six years of double digit growth. Additionally, the modest recovery in 1986 is somewhat deceptive, because it was attributable entirely to gains by NBC; advertising revenues for CBS and ABC were both down again.[72]

Technological changes and other developments make it unlikely that the networks will ever recover their long-held dominance of television advertising. Computers currently allow advertisers to simulate national audience reach through purchases from local stations that are as efficient in some cases as network buys. Sophisticated advertisers are also finding ways to attain nationwide coverage through a combination of local media.

Late last year, for example, Procter & Gamble, the largest network advertiser, invested $10 million in a combined advertising package involving six independent stations owned by Tribune Broadcasting and cable "superstation" WTBS.[73] The arrangement will enable P&G to reach 65 percent of the nation's households at a cost 15 percent below network rates. Additionally, use of WTBS will give P&G access to cable households where network viewership is generally lower than average. If the advertising package works, P&G may invest more money that may otherwise have gone to network advertising.

The introduction of a new audience measurement system - peoplemeters - will further erode the networks' traditional hold on advertisers. The peoplemeter combines a passive device that records what channel is being watched with a keypad used to record the age and sex of each member of the family watching. Relevant demographic data on each family member is also stored in the ratings service's central computers.[74]

Peoplemeters will give advertisers, for the first time, daily access to ratings and demographic data for network, syndicated, and cable programming throughout the entire year.[75] Moreover, advertisers will not only know the size and demographic composition of their audiences, but also "whether they tuned into [a] program from the previous show on the same network, or came from another network, a cable channel or elsewhere, as well as where they go after [the] show is over."[76]

Advertisers will therefore be able to identify the audience segments most suited for their products and services and track their viewing patterns with great accuracy. They could therefore "target" their commercials more precisely and, thus, spend their advertising dollars more effectively. One outcome will likely be decreased interest by many advertisers in the "mass audience" typically provided by network programming in favor of more specialized programming available on independent stations or cable television.

Finally, the effects of the new market environment are also reflected in the volatility of the networks' profits and the reduction in their profit margins. Table 6 sets forth available data on network profits for the past 5 years.

In response to stagnating revenues and diminishing profit margins, the networks have moved aggressively to cut costs. In programming, the networks refused to pay more for television rights to National Football League games, even at the expense of losing some of those games to ESPN, a cable network. They have also increased pressures on program producers to control production costs for prime time programming. In late 1986, moreover, the networks turned down a proposed agreement with the Hollywood studios to continue the terms of a consent decree (scheduled to terminate in November 1990) that restricts the amount of prime time programming each network can produce.[77] Clearly, the networks will be better able to control program costs if they are producing the programming.

At the same time, the networks are paring labor costs. Soon after Capital Cities Broadcasting took over ABC, it laid off 1,400 of the network's 14,000 employees.[78] Similar lay-offs followed at CBS and NBC. Recently, NBC negotiated an end to a lengthy strike with the National Association of Broadcast Engineers and Technicians, winning broader rights to use more temporary employees in place of more expensive union technicians.

Several of the networks have also expanded into other distribution media. ABC and NBC own a share in the Arts & Entertainment cable network. ABC News

TABLE 6[79]
Commercial Television Network Profits

Year	Revenues (Billions)	Profits (Losses) (Millions)	Profit Margin (Profits/ Revenues) (%)
1987			
ABC	--	50	---
CBS	2.35	50	2.1
NBC	2.70	250	9.3
1986			
ABC	--	(70)	---
1985			
ABC	2.20	166	7.5
CBS	2.30	226	9.9
NBC	2.20	202	9.2
1984			
ABC	2.64	260	9.8
CBS	2.24	280	12.5
NBC	1.93	100	5.2
1983			
ABC	2.07	2.35	11.3
CBS	1.95	190	9.7
NBC	1.70	55	3.2
	1.66	72	4.4
1982			
ABC	1.86	210	11.3
CBS	1.78	170	9.6
NBC	1.50	25	1.7
	1.48	32	2.2

recently announced plans to produce 26 hour-long episodes on the cold war for A&E.[80] In May 1988, NBC purchased a cable network and immediately announced plans to offer a 24 hour business/sports programming service.[81]

These efforts will likely improve the networks' bottom lines in the short term. In 1987, for example, cost cutting at CBS and ABC, coupled with modest increases in advertising revenues, helped turn projected losses for that year into slight profits. In 1988, the networks should also benefit further from the advertising surge that typically accompanies an Olympics/election year. It is not surprising, then, that some analysts are predicting a healthy recovery in network profits through 1991, with NBC leading the way.[82]

Evolution of Network/Affiliate Relations

One potential network cost-cutting measure, however, may in the long run fundamentally alter one of the pillars of the television industry -- the bonds between the networks and their affiliates. For decades, each network has paid local stations for agreeing to carry network programming (and accompanying commercials).[83] By accumulating those affiliates, the networks could increase the potential audience for their shows and, thus, increase the rates advertisers would be willing to pay to reach that audience. In turn, the affiliates obtained a steady flow of programming with virtually no financial risk.

By 1986, affiliates were receiving about $425 million annually in network compensation.[84] Those payments have attracted close scrutiny in an era of shrinking network revenues and profits. Compensation payments have also become vulnerable because affiliates have generally not experienced the networks' financial problems to the same degree.[85] In 1986, for example, the three networks reported profits of approximately $400 million (with ABC reporting a loss) on revenues of $8 billion; their 600 plus affiliates earned about $3.5 billion on revenues on $10 billion.[86]

Faced with large losses for 1986, ABC was the first network to consider cutting network compensation, proposing to reduce payments by 25 percent over a five year period.[87] CBS subsequently proposed a plan to reduce compensation for prime time programs in return for increases during the day and late night. Only NBC, with higher profits and ratings, and hoping to attract affiliates from the other networks, chose to increase its payments to affiliates.

The ABC and CBS proposals met with a storm of criticism. Affiliates were angered that the networks were changing a long-standing arrangement to avoid the consequences of bad programming decisions. As one ABC affiliate put it, "They're losing money because their shows get lousy ratings -- and now we're punished for their sins."[88] Nevertheless, many affiliates are doubtless trying to protect their bottom lines as well. In the top 10 markets, network compensation represented, on average, 3 percent of an affiliate's net revenues and 9 percent of their pretax profits. In markets 101 to 200, where compensation is more important to stations because advertising rates are generally lower, those figures were 8.4 percent and 107 percent, respectively.[89]

Despite affiliates' objections, the networks did obtain some changes in the network/affiliate relationship. ABC reduced network compensation by $3 million for 1987. Although CBS was not able to reduce its payments, it was able to gain approval for an additional 5 minutes of commercials per week in prime time for the 1987-88 season.[90] NBC, currently the most successful network, increased compensation, but took back 90 seconds of commercial time previously given to affiliates, thus largely erasing the benefits of the increased compensation.

The controversy over network compensation may fundamentally alter the traditionally close partnership between the networks and their affiliates. Reacting to potential cuts in compensation, some affiliates are making thinly veiled threats to increase their preemption of low-rated network programming. Preemptions are not a new phenomenon, as affiliates have frequently replaced network programs with, for example, local sports. But many observers have detected an increase in such preemptions in recent years. With the proliferation of programming sources and, especially the rise in local advertising rates, affiliates are finding they can make more money by replacing network fare (and network advertising) with syndicated or locally-produced programming, selling all of the commercial time, and keeping the revenues. Reductions in network compensation can only make preemption more attractive for affiliates, further loosening the ties that have long bound affiliates to networks.

At the same time, technological changes, such as the proliferation of satellite capacity, may make the networks less dependent upon local stations for the distribution of network programming. NBC, for example, has already authorized one satellite carrier, Netlink, to distribute NBC programming to home earth stations outside affiliates' service areas. ABC is reportedly close to an agreement with the same firm.[91] CBS is working with Bellcore, the research arm of the Bell Operating Companies, to test the feasibility of using fiber optic cable to deliver network programming to affiliates. With either technology in place, it would not be a major jump for the networks to deliver programming directly to the home, completely bypassing their affiliates.

Despite the increased tensions between networks and affiliates, the relationship will likely remain intact for the foreseeable future. One fundamental reason is that the networks also own affiliates in major markets. Since those network owned-and-operated stations ("O&Os") frequently generate pretax profit margins exceeding 30 percent, they represent lucrative investments. Their value is further accentuated by the presence of network affiliates in other markets. It appears, moreover, that the networks' commitment to the concept of local affiliates has not weakened. NBC recently completed a very controversial acquisition of a soon-to-be ex-CBS affiliate in Miami, giving NBC a total of six O&Os. CBS recently purchased a fifth O&O in the Miami area. In short, the networks appear to have too great an investment in the network/affiliate partnership to abandon it, at least in the short term.

Challenges for Independent Stations

After experiencing a burst of growth in the early 1980s, independent stations are facing an increasingly uncertain future. Signs of a shake-out are growing. By January 1988, some 23 independents, mostly UHF operations in markets with multiple independent stations, had declared bankruptcy.[92] The most publicized of these, Grant Broadcasting, owner of stations in Miami, Philadelphia, and Chicago, cited debts of $194 million, including $24 million to program suppliers.[93] Several program suppliers have increased their bad debt reserves in anticipation of contract defaults by independent stations.[94] After a surge in sales prices for independent stations after 1982, prices abruptly fell in 1986.[95]

In a sense, the independents have been victims of their own success. By 1986, the dramatic growth in the number of independent stations began to produce diminishing returns. In November 1981, for example, there was an average of 2.3 independent stations in the top 20 television markets. By the end of 1987, 16 of the top 20 markets had four or more independents; 43 of the top 50 markets had two or more.[96] At the same time, however, the independents' average audience share has leveled off. Although the average share rose from 14 percent to 21 percent between 1980 and 1985,[97] it has hovered around 21 percent since.[98]

As more and more stations compete for a stagnant number of viewers, each station has viewed programming as a way to differentiate itself and gain an advantage with viewers and advertisers. The aggressive bidding has sharply increased the price of that programming. Since 1980, independents' program costs have doubled, and the Association of Independent Television Stations projects that costs will double again by 1990.[99]

While programming costs have skyrocketed, independents have suffered along with network affiliates from the softened advertising market. While spot and local advertising revenues are rising more rapidly than network advertising revenues, their growth does not approach the rates experienced in the late 1970s and early 1980s, when the number of independents was expanding rapidly. Many stations agreed to pay higher programming costs on the assumption that advertising would remain strong, and they now are squeezed between higher costs and slackening revenues.

Regulatory changes have also harmed independents. For example, independents benefited from the spread of cable television because the FCC's "must carry" rules required cable systems to carry the signals of all local stations. Cable carriage allowed the predominantly UHF independents to minimize the technical limitations of UHF transmission, thus increasing their ability to compete with VHF rivals. In 1985, however, a Federal appellate court voided the must carry rules as violative of the First Amendment.[100] Although the FCC attempted to craft new rules that would pass constitutional muster, they were struck down in December 1987.[101]

Despite these uncertainties, independent stations will survive, although they will have to work harder for their profits. The disappearance of some stations will marginally reduce the supply of advertising slots, as well as the demand for programming. As a result, market pressures will be somewhat less for surviving stations. More importantly, independents have firmly established themselves in many markets, capturing about 25 percent of all national and local television advertising revenues. Thus, long-established independents (particularly those operating on VHF channels) will continue to do well. The prospects are less bright for the more marginal independents, such as new entrants, undercapitalized stations, or the third and fourth independents in a market.

Rise of a Fourth Network

Fox Broadcasting's purchase of six independent stations from Metromedia served as the springboard for the establishment of a fourth national television network. Built on that six station core, the Fox Broadcasting Network currently has some 121 affiliates (including the six owned and operated stations) that reach 86 percent of the country.[102] The network currently delivers 10 1/2 hours of programming a week to its affiliates (two hours on Saturday, three and a half hours on Sunday, and the remainder on weeknights after 11PM).[203]

Thus far, the results are mixed. While Sunday ratings have been good, Saturday ratings have been disappointing. Fox may have to defer for the second time plans to introduce a third night of programming because affiliates might not support a new night until the Saturday schedule is put in order.[204] More significantly, the Fox network lost about $80 million in 1987, well above forecast losses of $50 million.[205] Owner Rupert Murdoch has apparently ordered that 1988 losses not exceed $40 million.[206] Among other things, this may restrict the network's ability to replace failed shows or to develop another night of programming.

On the other hand, other signs are more encouraging. The six Fox-owned stations earned profits of $90 million in 1987,[207] more than offsetting the network's losses. Most Fox affiliates, moreover, are not displeased with the network's performance so far. Because an independent station's least profitable time period is 8-11 PM (doubtless because of competition from the networks' prime time schedules), most affiliates are taking no great financial risk by carrying the Fox network.[208] Indeed, the network's Sunday schedule has improved affiliates' ratings and revenues.

Additionally, Fox programs are attracting the younger audiences (18-49 years old) that advertisers covet most. Because of the quality of its audience, Fox did not have to give advertisers rebates after its initial Emmy telecast in 1987, even though overall ratings were well below promised levels. The Fox network's prime demographics may keep advertisers satisfied until ratings improve. In short, although the new fourth network has its troubles, it is premature to predict that Fox will eventually go the way of the DuMont network.

Reform of the License Renewal Process

The FCC's deregulatory initiatives of the past decade have left largely unaffected one major area of broadcast regulation -- the procedures and policies governing license renewals. Under the Communications Act, broadcast licensees must periodically apply to the FCC for renewal of their licenses to operate. The FCC must then determine in each case whether renewal of the incumbent's license will serve the public interest. When a renewal application is filed, however, interested parties can petition to deny the application or even file a competing application. If a competing application is filed, the FCC must decide, in a comparative proceeding, which applicant will better serve the public interest.

While petitions to deny or competing applications can alert the FCC to deficiencies in the incumbent's past performance, they are also commonly used to extract concessions, including cash settlements, in exchange for withdrawal of the petition or application. Moreover, since comparative hearings rarely result in denial of the incumbent's license, the lengthy process consumes time and money without any discernable benefits to the public.

Concerned about these problems, Congress has recently considered reforms to the license renewal process. Several bills introduced last year would replace existing procedures with a two-tier approach.[109] In the first stage, the incumbent's record would be evaluated, on a non-comparative basis, to determine whether it had satisfied a specified minimum level of performance. If so, the incumbent's license would be renewed. Competing applications would be considered in a second stage only if the incumbent had failed the initial review.

In defining the minimum performance necessary to obtain renewal without comparative review, the various bills all propose to consider the incumbent's past programming.[110] They differ materially, however, in the degree to which programming would be scrutinized. H.R. 1140 requires only that the incumbent has broadcast material responsive to matters of concern within its service area. H.R. 3493, on the other hand, would require service to be both "responsive" and "meritorious," although the terms are not defined further. S. 1277 speaks of meritorious service, but specifically links that standard to two types of programming, non-entertainment and children's programming.

To date, the bills have not moved forward because of fundamental disagreements between Congress and the broadcast community. Although broadcasters desire relief from comparative renewals, they object, putatively on First Amendment grounds, to a revised renewal standard that focuses too keenly on a licensee's programming decisions. On the other hand, many influential Congressmen, concerned about the pace of broadcast deregulation generally and particularly upset by the FCC's repeal of the Fairness Doctrine, have insisted that any renewal reform bill contain significant programming obligations.

Recently, the FCC initiated a rulemaking to consider reforms to the comparative renewal process,[111] in part because legislative action is unlikely.[112] The FCC has, over the years, developed a set of criteria for evaluating competing applicants in a comparative renewal. The most decisionally significant of these factors is the "renewal expectancy" available to incumbent licensees.[113] The FCC traditionally has determined whether an incumbent licensee merits a renewal expectancy by reviewing its past programming performance.[114] The weight of the renewal expectancy is measured on a sliding scale in accord with the strength of the licensee's past broadcast record.[115]

In the current proceeding, the FCC is, among other things, attempting to specify the type of performance sufficient to warrant a renewal expectancy.[116] In so doing, it faces a fundamental dilemma. A content-neutral standard would both promote First Amendment values, which the FCC strongly supports, and continue the FCC's stated "deregulatory initiatives over the past decade, which have sought to narrow the scope of the Commission's involvement in program decisionmaking and evaluation."[117]

On the other hand, removing review of past programming from the comparative process eliminates the incumbent's best defense against a competitive challenge. The FCC has resolved this dilemma by proposing a renewal expectancy test that incorporates the minimal program requirement of H.R. 1140. Given the preference among some Congressmen for a stronger standard, it remains to be seen whether the FCC's proposal will be adopted without modification.

Renewal reform has also created a dilemma for some broadcasters. Although most broadcasters want the same degree of First Amendment protection accorded other communications media, many recognize that full First Amendment regulation would necessarily eliminate the public interest regulations that have created a "special status" for broadcasting over the years. This special status has, among other things, been seen to justify "must carry" obligations for cable television, as well as the use by broadcasters of valuable spectrum without cost. As a result, independent broadcasters, who have the most to lose from elimination of must carry rules, have generally been more receptive to retention of some content-specific public interest standard for broadcasters.[113] Other broadcasters are more reluctant to risk compromising their First Amendment rights in this fashion.

High Definition Television

High Definition Television or HDTV is a generic term referring to a new generation of television receivers and production equipment. HDTV will provide superior picture clarity and a larger aspect ratio compared to current receivers. HDTV technology could revolutionize television, and become a $25 to $50 billion market in the next decade.[114] HDTV could radically change the competitive environment should some media, *e.g.*, cable or VCRs, implement HDTV early, in a manner different from a system developed later for terrestrial broadcasters.

The current television technology, known as NTSC, was developed by the National Television System Committee in 1940, when television was in its infancy. The NTSC system, originally developed for monochrome (black-and-white) transmissions and subsequently enhanced to include color and stereo sound, uses 525 lines per frame and has a 4:3 aspect (width-to-height) ratio. HDTV transmissions will have more than twice as much information per frame, over 1100 lines, and approximately a 5:3 aspect ratio. The resulting difference is that while NTSC transmissions are like a 16mm film, HDTV creates a picture similar in clarity, brightness and color to a 35mm motion picture shown in theatres.

There are two distinct major issues concerning the introduction of HDTV. The first is the establishment of a standard for the production of HDTV video programming. The second, is the development of transmission standard(s) for terrestrial broadcasting, and perhaps, other media.

In 1986 the United States and Japan requested that the International Radio Consultative Committee ("CCIR"), part of the International Telecommunications Union, adopt as the worldwide production standard a system developed by the Japan Broadcasting Corporation ("NHK"). Developed in the 1970s and first demonstrated in 1981, the NHK system is the original and most widely accepted HDTV system. It has 1125 lines per frame, a 60 Hz scanning frequency (producing 30 frames per second), and a 5:3 aspect ratio. The European nations did not want to accept the NHK standard, however, since it is incompatible with their current television systems which use 50 Hz, and they blocked the adoption of a worldwide standard. Instead they are developing their own system, called Eureka, which will have 1250 lines per frame, a 50 Hz scanning frequency, and a 16:9 aspect ratio. These two systems will be presented for consideration as a worldwide production standard at an extraordinary session of the CCIR scheduled for November 1988.[120] NHK expects to have HDTV production equipment on the world market in 1989.[121]

Within the United States, a primary concern in the development of HDTV is the establishment of a broadcast transmission system that is compatible with the current NTSC system. This compatibility question focuses on two aspects of an HDTV transmission: (1) the bandwidth requirement for broadcast transmissions, and (2) the ability of NTSC receivers to receive a viewable signal from an HDTV transmission.

The current allocation for television in the United States is based upon 6 Mhz channels, which is the NTSC transmission standard. HDTV transmissions, with their increased picture clarity, may not be able to contain all of the information in that bandwidth. For instance, the NHK MUSE system, currently the most tested HDTV transmission system, requires 8.1 MHz bandwidth.[122] On the other hand, the ACTV system, developed by NBC, needs only 6 MHz, and thus can be used within the existing television allocation table.[123] Other systems are being developed by North American Phillips Corporation, The Del Ray Group, the New York Institute of Technology, Bell Laboratories, General Electric and CBS, Inc. A European system is scheduled for introduction in late 1988 or early 1989.[124]

If HDTV requires a larger bandwidth channel than currently allotted to television, the FCC may have to reallocate the television allocation. Other services, such as land mobile radio, have also sought to have allocations in the UHF television band. The FCC has placed a freeze on television assignments in the top 30 markets until it determines how to treat HDTV.[125]

Other transmission systems, such as cable television, do not face this problem, however, and thus may be able to deliver to viewers HDTV before broadcast television. The Japanese plan to begin transmitting HDTV from a direct broadcasting satellite in 1990.[126] In the United States, HDTV could be available through VCRs and over cable television by 1991.[127] If broadcasters are not able to provide HDTV in the same time frame as other media, they might be competitively disadvantaged.

A potential problem faced by all of the various transmission systems, however, is the compatibility of HDTV transmissions with NTSC receivers. There are currently over 130 million NTSC television receivers in the United States, valued at over $80 billion.[128] The total investment in existing NTSC system equipment is over $100 billion.[129] If HDTV transmissions are not viewable on NTSC receivers, this equipment may be obsolete. This lack of compatibility, coupled with the high initial costs of HDTV receivers, estimated to be up to $4,000 each,[130] may retard the development of HDTV. It may be possible, however, to develop an adapter so that NTSC receivers could display a viewable picture from an HDTV transmission.

On September 1, 1988, the FCC issued several preliminary findings and conclusions regarding advanced television systems ("ATV"), including HDTV.[131] First, it determined that the benefits of ATV technology can be attained most quickly by allowing existing commercial television broadcasters to implement HDTV and other advanced systems. Second, the FCC concluded that initial ATV signals must be compatible with existing NTSC receivers or those signals must be provided on a separate channel. This requirement ensures that implementation of HDTV would not obsolete the public's embedded investment in television sets. Third, the FCC declined to allocate additional spectrum for ATV. In other words, if ATV technology requires more than the current 6 MHz channel, the additional spectrum would have to be found in the existing VHF and UHF frequency bands.

Additionally, the FCC solicited comments on four possible spectrum plans for ATV: "(1) that no additional spectrum be utilized, (2) that a 3 MHz channel not necessarily contiguous to the main channel be utilized to supplement the existing 6 MHz channel; (3) and (4) that 6 MHz not necessarily contiguous be provided to either augment the main channel or to provide for simulcasting programs during a transition period."[132]

Major Trends

Commercial broadcast television is expected to remain the dominant means of delivering programming to the home for the foreseeable future, as broadcast stations will continue to attract the lion's share of both viewers and advertising dollars. While network ratings have declined -- and will doubtless decline further -- a portion of the audience appears to have migrated to other broadcast stations (the independents) rather than to basic cable television services or to pay television. Although cable television is available in about one-half of the nation's households, cable systems still rely heavily upon retransmission of commercial broadcast signals to attract and hold subscribers.

The networks and local broadcast stations should continue to capture the bulk of television advertising revenues because over-the-air broadcasting remains the most effective way to reach consumers via television. Even though a network program now reaches only 14 percent of the nation's households, it is still the only vehicle for reaching that many people. While peoplemeters will lessen the importance of mass audiences by enabling advertisers to identify and target valued segments of the consuming public, many of those choice audience segments watch broadcast programs in numbers far larger than any other television source.

The long term future of commercial broadcasting is less certain, however. A crucial barometer will be the network/affiliate relationship. A major change in that partnership will have fundamental implications for the structure of the broadcast industry. If the partnership terminated, advertisers could no longer be assured of nationwide audiences for their commercials. Lacking easy access to the mass audience, advertisers would likely turn to other distribution media (such as cable television) that are equally effective in reaching smaller, more specialized audiences.

Expansion of alternative distribution media may also determine the future of commercial broadcasting. The introduction of high powered satellites and smaller receiving antennas may finally make DBS a viable service. Similarly, the much-talked about introduction of fiber optic cable into the telephone network has raised the prospects of a broadband network capable of delivering a vast number of video channels to each home. If either of these transmission alternatives catch on, the broadcast networks and other program suppliers may find it more efficient to market service directly to the home and to bypass local broadcast stations entirely.

Notes

1. *Communications Daily*, May 5, 1988, at 11, citing 1988 Nielsen Report on Television. More than 60 percent of American households have more than one set. *Id.*

2. This represents a 5 minute per day decline from the previous year. The decline in television viewing between 1986 and 1987 was the first in recent memory.

3. *Broadcasting*, Aug. 22, 1988, at 11. As of that month, the FCC had authorized construction of an additional 218 commercial stations (18 VHF and 200 UHF). *Id.*

4. The steady rise in the number of commercial stations over the past three decades has dramatically increased the viewing choices available to television households. In 1964, for example, only 8 percent of households received as many as nine broadcast stations. By 1987, that figure was 86 percent. Source: A.C. Nielsen.

5. Sources: *1987 Broadcasting/Cablecasting Yearbook* at A-2; *1986 Broadcasting/Cablecasting Yearbook* at A-2; *1982 Broadcasting/Cablecasting Yearbook* at A-7; "Broadcast Station Totals as of December 31, 1984," FCC Mimeo 1810 (released Jan. 9, 1985). Station totals are for January 1 of each year, with the exception of 1985 through 1987. Totals for each of the latter three years are as of December 31 of the preceding year.

6. Howard, *Group and Cross-Media Ownership of Television Stations: 1986* at 7-8 (May 1986) (published by the National Ass'n of Broadcasters).

7. *Id.* at 4.

8. *Id.*

9. Of the 1018 commercial broadcast stations operating on October 15, 1987, 647, or 63.6 percent, were network affiliates. *1988 Television & Cable Factbook* (Stations Volume) at A-16 thru A-1177. By way of comparison, in 1977, more than 75 percent of all commercial stations were network affiliates. *Commercial TV Network Practices*, 62 FCC 2d 548, 551 (1977).

10. Richter, *Independents' Day*, Los Angeles Times, Apr. 18, 1988, Pt. IV, at 17.

11. Television Information Office, *TIO Quick Takes*, No. 27 (July 1988).

12. *Broadcasting*, Feb. 29, 1988, at 68-70.

13. Because we could not determine exactly how many independent stations were operating at the end of 1987, the December 1987 data reflect a range drawn from two sources. The 1988 census of the Independent Television Association identified 310 operational independent stations at the end of 1987. INTV Journal, Jan. 1988, at 26. The 1988 Television & Cable Factbook (Stations Volume) lists 371 independent stations operating as of October 15, 1987. INTV's count may be somewhat low, since its census probably did not encompass all independents. On the other hand, the Factbook's list includes satellite stations, which merely retransmit programming originally broadcast by another station. Thus, the Factbook likely overstates the number of separately-programmed independent stations.

14. Sources: NCTA Position Paper on Syndicated Exclusivity, Table 6 (May 1987) ("NCTA Position Paper"); Comments of the Association of Independent Television Stations, Inc. in GEN. Docket No. 87-24, at 28 (filed July 20, 1987) (station data for December 1980).

15. National Ass'n of Broadcasters, 1986 Television Financial Report, Table 64; N.Y. Times, July 1, 1985, at D2.

16. As of October 15, 1987, 88.4 percent of all independent stations (328 out of 371) occupied UHF channels. 1988 Television & Cable Factbook (Stations Volume) at A-16 thru A-1177. In contrast, 23.8 percent of network affiliates (154 out of 647) and 64.2 percent of all non-commercial stations (219 out of 341) operated on UHF channels. Id.

17. Under FCC rules, the maximum power for VHF stations is 316 kilowatts; the maximum power for UHF stations is 5,000 kilowatts. 1987 Broadcasting/Cablecasting Yearbook, at A-5, citing 73 C.F.R. 73.614 (1986).

18. Development of UHF television was further aided by the passage of the All Channel Receiver Act, Pub. L. 87-529, 76 Stat. 150 (1962) (codified at 47 U.S.C. 303(s) (1984)), which required that all television receivers be capable of receiving all UHF channels.

19. Advertising Age, Jan. 4, 1988, at 3. An average 30-second commercial in prime time on NBC cost $150,625, a 20 percent increase from October 1986. ABC charged $111,800 (up 6 percent), and CBS $103,130 (a 2 percent increase). Id.

20. Communications Daily, Nov. 20, 1987, at 10.

21. Id. By way of comparison, the most expensive 30-second spot on the ABC affiliate in Chicago, the third largest television market, cost $6,500. 1988 Television & Cable Factbook (Stations Volume) at A-344. A 30-second commercial on a network affiliate in the smallest television market, Glendive, Montana, costs no more than $150. Id. at A-641.

22. Sources: For 1987, Communications Daily, Feb. 18, 1988, at 8 (data provided by the Television Bureau of Advertising. For the preceding years, Television Bureau of Advertising, Trends in Advertising (June 1987).

23. Sixth Report and Order on Television Allocations, 41 FCC 148 (1952).

24. FCC Network Inquiry Special Staff, New Television Networks: Entry, Jurisdiction, Ownership and Regulation, Vol. I, 3-4 (Final Report) (1980).

25. 47 C.F.R. 73.3555 (1986). The regulations also permit exceptions to the "cross-ownership" restrictions in certain circumstances.

26. National Broadcasting Co. v. FCC, 319 U.S. 190, 216 (1943).

27. In 1981, the license for television broadcasters was extended from three to five years. Omnibus Budget Reconciliation Act of 1981, Pub. L. 97-35, Sec. 1241, 95 Stat. 736, amending 47 U.S.C. 307(d).

28. See, e.g., Address of Mark S. Fowler, Chairman, FCC, before NATPE International, Inc., Las Vegas, Nevada, Mar. 15, 1982.

29. Revision of Applications for Renewal of License of Commercial and Noncommercial AM, FM, and Television Licensees, 46 Fed. Reg. 26236 (1981), aff'd sub nom. Black Citizens for a Fair Media v. FCC, 719 F.2d 407 (D.C. Cir. 1983), cert. denied, 467 U.S. 1255 (1984).

30. Amendment of Section 73.3597 of the Commission's Rules, 52 R.R. 2d 1081 (1982), modified, 99 FCC 2d 971 (1985).

31. Amendment of Section 73.3555 of the Commission's Rules Relating to Multiple Ownership of AM, FM and Television Broadcast Stations, 100 FCC 2d 17 (1984), modified, 100 FCC 2d 74 (1985), appeal docketed sub nom. National Ass'n of Black-Owned Broadcasters v. FCC, No. 85-1139 (D.C. Cir., Mar. 4, 1985). An individual or firm can also have an ownership interest in two more stations (serving an additional 5 percent of the nation's population) if those stations are minority-controlled, and UHF station coverage is discounted by 50 percent. 47 C.F.R. 73.3555 (d) (1986).

32. See, e.g., Elimination of Unnecessary Broadcast Regulation, 57 R.R. 2d 913, recon. denied, 58 R.R. 2d 864 (1985), aff'd sub nom. Telecommunications Research and Action Center v. FCC, 800 F.2d 1181 (D.C. Cir. 1986) (removed FCC policies concerning false and misleading commercials, distortion of audience ratings, promotion of station's non-broadcasting businesses); Elimination of Unnecessary Broadcast Regulation, 50 Fed. Reg. 6246 (1985) (eliminated policy statement cautioning stations from, among other things, broadcasting "scare" announcements, such as "the amoebas are coming").

33. *Report and Order in MM Docket No. 83-670*, 98 FCC 2d 1076 (1984), *recon. denied*, 104 FCC 2d 358 (1986), *aff'd in part and rev'd in part sub nom. Action for Children's Television v. FCC*, 821 F.2d 741 (D.C. Cir. 1987).

34. *Syracuse Peace Council*, 2 FCC Rcd 5043 (1987).

35. Source: *1988 Television & Cable Factbook (Cable and Services Volume)* at C-358. A.C. Nielsen estimated that there were some 57.2 million television households in the United States (excluding Alaska and Hawaii) in September 1968.

36. Source: *1969-1970 Television & Cable Factbook (Services Volume)* at A-79.

37. Sources: *1988 Television & Cable Factbook (cable & Services Volume)* at C-299; *Broadcasting*, Aug. 22, 1987, at 11.

38. Source: *1988 Television & Cable Factbook (Cable and Services Volume)* at C-358.

39. Source: *Id*. at C-359.

40. *Communications Daily*, Apr. 27, 1988, at 6 (citing estimates of A.C. Nielsen).

41. *Id*., June 10, 1988, at 9 (citing Nielsen February VCR Activity Report).

42. *Id*.

43. *Direct Broadcast Satellites*, 90 FCC 2d 676 (1982).

44. Section 605 of the Communications Act, 47 U.S.C. 605 (a) (Supp. III 1985), prohibits unauthorized interception of signals not intended for use by the general public. The unanswered question was whether or not an unscrambled satellite signal, which can be received anywhere within the continental United States, was intended for use by the general public.

45. *See id*. 705(b).

46. *Communications Daily*, Apr. 15, 1988, at 1. TCI's target market is the 10.4 million homes without access to cable television. The firm projects 1.5 subscribers in the first year of operation, 9 million subscribers by the sixth year, and breakeven by 1997. *Id*.

47. *Id*., Apr. 11, 1988, at 3.

48. For an extensive discussion of HDTV, see *infra*.

49. *An Inquiry into the Future Role of Low Power Television Broadcasting and Television Translators in the National Telecommunications System*, 47 Fed. Reg. 21468 (1982), *modified on recon.*, 48 Fed. Reg. 21478, *recon. denied* FCC 83-486 (released Oct. 27, 1983).

50. *Broadcasting*, Aug. 22, 1988, at 11. Construction permits have been issued for an additional 1,306 stations (163 VHF and 1,143 UHF). *Id.*

51. *See Subscription Television Service*, 3 FCC 2d 1 (1966).

52. *See Multipoint Distribution Service*, 45 FCC 2d 616 (1974).

53. National Ass'n of Broadcasters, *Great Expectations: A Television Manager's Guide to the Future* 25 (1986) ("*Great Expectations*"). Although a few former STV stations terminated operations completely, most of the others continued operating as advertiser-supported independents.

54. *Id.*

55. *Amendment of Parts 2, 21, 74 and 94 of the Commission's Rules and regulations in regard to frequency allocation to the Instructional Television Fixed Service, the Multipoint Distribution Service, and the Private Operational Fixed Microwave Service*, 94 FCC 2d 1203 (1983), *recon. denied*, 98 FCC 2d 68 (1984).

56. Source: Federal Communications Commission.

57. *Broadcasting*, October 5, 1987, at 48. The $18.95 fee applies after six months. The charge for the first six months is $24.95.

58. *Communications Daily*, Nov. 17, 1987, at 4.

59. 47 C.F.R. 21.904(b) (1986). To operate at maximum power, an MMDS licensee must make a special showing that the increased power is necessary to provide "adequate, reliable service to a reasonable service area" and will not cause harmful interference to other MMDS operations. *Id.* Without a special showing, MMDS transmitters are limited to 10 watts. *Id.* 21.904(a).

60. *See Communications Daily*, Nov. 17, 1987, at 4.

61. *Broadcasting*, Oct. 5, 1987, at 48.

62. *Id.*

63. Of the 631 commercial broadcast stations operating on December 31, 1969, 499, or 79.1 percent, were network affiliates. *Network Television Broadcasting*, 23 FCC 2d 382, 385 (1970).

64. See note 10, supra, and accompanying text.

65. Hickey, Can the Networks Survive?, TV Guide, Mar. 21, 1981, at 7.

66. Broadcasting, Aug. 3, 1987, at 66. The ratings decline is even more pronounced in households with cable, where the networks' audience share averaged 53 percent in 1987. Cable Advertising Bureau, Inc., Cable TV Facts '88, at 6 (based upon data from A.C. Nielsen).

67. Network audience shares hovered around 75 percent between the 1984/85 and the 1986/87 prime time seasons. See Broadcasting, Apr. 20, 1987, at 42 (75 percent); id., Apr. 28, 1986, at 35 (76 percent); id., Apr. 22, 1985, at 106 (77 percent). For the 1987/88 season, prime time audience shares declined to 71 percent. Mahoney and Buckman, ABC, CBS, and NBC battle new erosion, Electronic Media, Apr. 25, 1988, at 57.

68. Broadcasting, Oct. 12, 1987, at 42. The networks' combined audience was 65 percent in July 1986, down 14 percent from the preceding April. Id.

69. Cable Advertising Bureau, Inc., Cable TV Facts '88, at 13 (based upon data from A.C. Nielsen).

70. Sources: For 1987, Communications Daily, Feb. 19, 1988, at 11 (data provided by the Television Bureau of Advertising. For the preceding years, Television Bureau of Advertising, Trends in Advertising (June 1987).

71. Fortune, Apr. 14, 1986, at 25.

72. Communications Daily, Feb. 18, 1987, at 8.

73. Collins, P&G Hedges Bet in Bold TV Buy, Adweek, Oct. 19, 1987, at 33.

74. For a more complete description of the peoplemeter service, see Broadcasting, Sept. 7, 1987, at 35-37.

75. The old Nielsen ratings had a two-week delay in the delivery of demographic data for network programming. Id. at 37. Additionally, demographic data was not available for about 13 weeks during the summer. Id., Jan. 5, 1987, at 61. Nielsen also used two separate mechanisms -- Home Video Index and Cassandra -- for collecting ratings and demographic data for cable and syndicated programming, respectively. Id. at 59.

76. Id., Sept. 7, 1987, at 39.

77. Broadcasting, Nov. 3, 1986, at 37.

78. Forbes, Aug. 10, 1987, at 36.

79. Sources: For 1987, Fabrikant, Talking Deals: The CBS Rumors on Network Sale, N.Y. Times, Apr. 14, 1988, at D2; for 1986, Forbes, Aug. 10, 1987, at 36; for 1984 and 1985, Communications Daily, Oct. 15, 1986, at 1; for 1982 and 1983, Communications Daily, July 31, 1984, at 2. The Communications Daily data with respect to NBC are estimates. For 1982 and 1983, Communications Daily was informed by a source (unnamed in the story) that its revenue and profit figures for NBC were too high and too low, respectively. We have therefore included the figures provided by the source for those years. The dashes in Table 6 indicate where data were not available.

80. Luchter, ABC News to Produce Series for A&E, Multichannel News, Aug. 29, 1988, at 1.

81. Communications Daily, May 3, 1988, at 3.

82. Communications Daily, Apr. 27, 1987, at 11.

83. Typically, an affiliate receives as compensation a percentage of its advertising rate for the relevant time period. For example, as of March 1987, a CBS affiliate carrying a prime time network program received a payment equal to 32 percent of the station's prime time advertising rate. For daytime and late night programming, that percentage dropped to 10 percent. See Advertising Age, Mar. 16, 1987, at 2.

84. Business Week, Apr. 13, 1987, at 104. CBS pays its 216 affiliates $174 million per year; NBC's 206 affiliates get $130 million; the 214 ABC stations receive $121 million. The networks also spent another $200 million per year for such things as promotion and local news-gathering.

85. While network advertising revenues have grown by about 3 percent since 1984 (from $8.53 billion to $8.79 billion), during the same period national/regional spot and local advertising sales (the primary source of affiliates' advertising revenues) increased by some 77 percent (from $10.57 billion to $13.67 billion). See Table 4, supra.

86. Richter, Networks Send Upsetting Signal to Local Stations, Los Angeles Times, Dec. 28, 1986, pt. 4, at 1.

87. Id.

88. Id.

89. Id. (citing a study by the National Association of Broadcasters).

90. Affiliates were allowed to control 90 seconds of that time.

91. Broadcasting, Oct. 26, 1987, at 6.

92. Grillo, The Cautious Survivors, Channels, January 1988, at 64. One analyst estimated that an additional 20 stations might be in financial trouble. Id.

93. Los Angeles Times, Jan. 1, 1987, Part 1, at 25.

94. Id., Jan. 17, 1987, pt. 1, at 25.

95. Channels at 38 (Jan. 1987).

96. Grillo, The Cautious Survivors, Channels, January 1988, at 64.

97. NCTA Position Paper at Table 8.

98. Nielsen ratings data indicate that the aggregate daily audience shares for all independent stations between August and November 1987 ranged from 19 percent to 24 percent. Electronic Media, Jan. 4, 1988, at 163.

99. Association of Independent Television Stations, Inc., quoted in Great Expectations at 56.

100. Quincy Cable TV, Inc. v. FCC, 768 F.2d 1434 (D.C. Cir. 1985), cert. denied, 476 U.S. 1169 (1986).

101. Century Communications Corp. v. FCC, 835 F.2d 292 (D.C. Cir. 1987), clarified, 837 F.2d 517 (D.C. Cir.), cert. denied, 56 U.S.L.W. 3816 (May 31, 1988).

102. Communications Daily, Apr. 11, 1988, at 6.

103. Fabrikant, Fox Still Finds Success Is Still Elusive, New York Times, Apr. 18, 1988, at 18.

104. Mahoney, Fox Broadcasting loses 3 major-market affiliates, Electronic Media, July 25, 1988, at 2. Indeed, Fox recently terminated affiliation agreements with stations in Miami, Minneapolis, and Portland, Oregon (two of which are VHF operations) in large part because those stations declined to carry the network's Saturday night schedule. Id. at 1-2.

105. Wash. Post, June 21, 1988, at D8.

106. TV Guide, July 16-22, 1988, at A-2.

107. Jones, Murdoch's Riches: His Edge in Post Talks, N.Y. Times, Feb. 19, 1988, at B1, B3.

108. Fabrikant, Fox Finds Success Is Still Elusive, N.Y. Times, Apr. 18, 1988, at 19.

109. See, e.g., S. 1277, the Broadcasting Improvements Act of 1987, 100th Cong., 1st Sess. (1987); H.R. 3493, the Broadcast License Reform Act of 1987, 100th Cong., 1st Sess. (1987); H.R. 1140, the Broadcast License Renewal Act of 1987, 100th Cong., 1st Sess. (1987).

110. Each bill defines minimum acceptable performance to include a requirement that the incumbent shall not have engaged in any willful or repeated violation of the Communications Act or FCC policies.

111. Formulation of Policies and Rules Relating to Broadcast Renewal Applicants, Competing Applicants, and Other Participants to the Comparative Renewal Process, BC Docket No. 81-742, FCC 88-212 (released Aug. 16, 1988) ("Further Notice"). The proceeding will also consider rule changes to prevent abuses of the renewal process.

112. See id. at n.19.

113. The FCC's justifies this policy as follows:
(1) "there is no guarantee that a challenger's paper proposals will, in fact, match the incumbent's proven performance"; (2) "the likelihood of renewal encourages licensees to make investments to ensure quality service which would not be made if their dedication to service is not 'rewarded'"; and (3) "the comparing of challengers and incumbents on the same basis as new applicants are compared could lead to an undesirable wholesale restructuring of the broadcast industry."

Id. para 59.

114. Id. para. 41.

115. Id. "Minimal" performance creates no renewal expectancy; "superior" performance creates a comparative preference that virtually guarantees renewal.

116. The FCC has also requested comment on the appropriate weight to be accorded other criteria in the comparative process (e.g., diversity of ownership, integration of management).

117. Further Notice, para. 102.

118. See, e.g., Communications Daily, June 23, 1988, at 3.

119. Rowen, High-Density TV, Wash. Post, Sept. 24, 1987, at A25.

120. Communications Daily, Aug. 6, 1987, at 5.

121. Broadcasting, Oct. 26, 1987, at 70.

122. NHK, Broadcasting Systems for HDTV, at 8 (undated).

123. Broadcasting, Oct. 5, 1987, at 35.

124. Communications Daily, Sept. 1, 1987, at 1.

125. FCC, "Inquiry Begun on Development and Use of Advanced TV Systems; Immediate Freeze on TV Allotments Imposed," Public Notice (July 16, 1987).

126. Wall St. J., Oct. 25, 1985, at 28.

127. Broadcasting, Oct. 26, 1987, at 64.

128. Broadcasting, Oct. 26, 1987, at 70.

129. N.Y. Times, Sept. 18, 1987, at 35.

130. Wall St. J., Aug. 24, 1987, at 25.

131. "FCC Announces Fundamental Policies and Defines Boundaries for Development of Advanced Television," Rept. No. DC-1235, Mimeo 4389 (released Sept. 1, 1988).

132. Id. at 2.

XII

Commercial Radio Broadcasting

by Anita L. Wallgren

Radio broadcasting, the oldest form of electronic mass communications dating back to the 1920s, has proven its adaptability over the last 30 years. While many thought the advent of television would wipe out the radio industry, in many ways radio is stronger than it was a generation ago. AM, or standard broadcast stations first confronted competition from television in the late 1940s and early 1950s and responded by developing new formats oriented around music and local events. Although authorized experimentally by the Federal Communications Commission (FCC) beginning in 1940, FM did not become popular until the mid 1970s when listeners began switching from AM to FM stations for higher fidelity, stereo channels, and innovative music programming.

Broadcast licensees, including radio broadcasters, are licensed by the FCC in the "public interest, convenience, and necessity."[1] Many believe that even without this legal obligation to serve the public interest, the great majority of broadcasters would fulfill a "public trustee" role because of the factors which are said to make broadcasting "different" from other businesses, including: the power and pervasiveness of broadcasting; the function of disseminating information considered essential to the proper functioning of a democratic society; and the combination of functions to inform, entertain, and enlighten the audience.

Almost 5,000 AM stations operate on frequencies assigned between 535 kHz and 1605 kHz, while another 5,000 stations operate on FM frequencies from 88 mHz to 108 mHz with 100 channels of 200 kHz each. The FM channels can be designated both by frequency (e.g., 88.1 mHz) and by channel number (e.g., Channel 201 is on 88.1 mHz). The AM service does not use channel designations.

Both AM and FM broadcasters today develop programming narrowly targeted for specific audiences with certain demographic characteristics, for example, 18 - 24 year old males in an urban market, or women 35 - 54 in a suburban market. Most stations broadcast a specific type of music, interspersed with news, weather, traffic, sports, and talk segments. Many stations affiliate with one or more national program networks for programming or news. Radio networks sell advertising time to advertisers wishing to cover all markets in the country; local stations sell time to local advertisers; and "rep" firms represent individual stations to advertisers placing "spot" buys. The spot advertiser can tailor its advertising to be aired in certain markets, on certain stations, at certain times of day, by working with station representatives.

Most stations are authorized by the FCC to operate on a 24-hour basis, although AM "daytimers" are limited to broadcast sunrise to sunset to avoid interference with other AM stations. The FCC permits stations to broadcast prerecorded programming on automated equipment with minimal supervision. Stations may "simulcast" the same programming over co-owned, co-located AM and FM facilities. Many believe that, today, radio in the United States constitutes the most competitive of the electronic mass media.

Key Industry Statistics

With over 500 million radios in use and over 99 percent of homes equipped with an average of five radios per home, radio is everywhere. Each week over 95 percent of all Americans listen to the radio, most listening is done in the car.[2]

Since 1970, the most dramatic change in radio has been the rapid rise of FM listenership and the increase in the number of FM stations. The number of stations on the air grew as indicated in the following table.

TABLE 1

Year	AM	% Increase	FM	& Increase
1955	2,669		552	
1965	4,009	50.2	1,270	130.0
1975	4,432	9.5	3,353	164.0
1985	4,754	7.3	4,888	45.8
1986 (Oct)	4,856	2.1	5,190	6.2
1988 (Jan)	4,902	0.9	5,342	2.9

Growth In AM And FM Stations[3]

Shifts in listenership corresponded to the larger increase in the number of FM stations. In 1975, about 70% of total radio audience listened to AM radio, while FM had an aggregate share of 30%. By 1985, that ratio was reversed, with FM holding 70% of audience share and AM 30%.[4] AM, however, maintained more than its proportionate share of revenues until 1986 when AM revenues were reported at 28.7% of all radio revenues, below the AM audience share of 29%.[5]

In 1988, there were well over 100 national and regional networks, with almost 8,000 stations affiliated with the top 15 networks. The six ABC Networks[6] accounted for 40% of radio network revenues.[7] Network revenues for 1987 were off slightly, with revenues estimated between a decline of 3 percent to an increase of 2 percent for the year,[8] after following a very uneven performance curve for most of the year. Perhaps the biggest network radio story in the last few years was the acquisition of the NBC radio networks by Westwood One in 1987.[9]

Although network revenues were generally flat or slightly off in 1987, local revenues for the first nine months of 1987 were up 6.3% over 1986.[10] Total radio revenues for 1985 were over 6.5 billion dollars, with about 75% from local sales. Local, spot, and network sales are all steadily increasing, so that total radio revenues increased about one billion dollars from 1981 to 1983, and about one and a half billion dollars from 1983 to 1985.[11] Advertisers could pay as little as $1.00 or as much as $1,000 for one 30-second spot.[12] In 1985, the typical station spent 31 cents of each expense dollar on sales and promotion, 37 cents on general and administrative costs, 22 cents on programming, five cents on news, and five cents on engineering.[13]

Station prices rose dramatically from 1976 to 1986. In 1976, 413 radio stations were traded at an average price of about $440,000, totalling $180 million. In 1985, more than 1,500 stations were traded at an average price of almost $1 million, totalling $1.4 billion.[14] The record year, however, was 1986, when station sales amounted to $3.2 billion.[15] The breakdown of these sales underscores the number of small stations that have always operated and still comprise a substantial segment of the radio industry:

TABLE 2

40%	under $500,000
15%	$500,000 to $1 million
18%	$1 million to $3 million
5%	$3 million to $5 million
6%	$5 million to $10 million
5%	over $10 million

1986 Radio Transactions by Sales Price[16]

One industry expert, Jim Duncan, recently ranked, in his view, the 13 most important events or trends in commercial radio from 1976 to 1986.[17] Duncan's top four items were:

4. There has not been a major new format developed in the last decade.[18]

3. FCC Deregulation.

2. Increased station trading and station prices.

1. FM's increase in audience share, and revenue; AM's corresponding loss in both.

In at least one other way, the radio business has changed significantly over the last ten years. Almost 40 percent of radio salespeople are women today, compared with only seven percent in 1976.[19]

Critical Industry developments

In its early days, radio was dominated by national program networks including NBC, CBS, and Mutual. Program networks clearly provided significant public benefits by providing affiliates with programming which they could not otherwise have produced. Some anticompetitive consequences were thought to flow from network practices, however, where the balance of commercial power between networks and affiliates tipped in favor of the networks. In 1940, the FCC adopted several "Chain Broadcasting Rules" and the Supreme Court affirmed the FCC's ability to do so, because the Commission had found it was in the public interest to limit the power of the networks over their affiliates.[20] The issue of "network dominance" since that time has proven much less controversial in radio than in television, in part, because few radio stations rely on networks for their entire program supply.

The FCC also sought early on to limit the number of radio stations owned by one entity. In the 1980s, the ownership limit of 7 AM and 7 FM stations was modified so that today one entity may control 12 AM and 12 FM stations.[21] The FCC is currently considering a proposal to modify or eliminate the rules which prohibit ownership in one market of more than one station in the same service (the "duopoly rule") and which prohibit ownership in one market of radio and television stations (the "one-to-a-market" rule).[22]

In 1981, Congress extended radio license terms from five to seven years, and television license terms from three to five years.[23] Later that year, the FCC adopted a brief "postcard" renewal form; these two actions have made renewal a much easier process for most radio licensees.

Current FCC rules permit any entity that meets the FCC's basic licensing criteria to file a "competing" application to a broadcast license at the time it is considered for renewal. If competing applications are filed, the FCC may initiate a "comparative hearing" process to determine whether the license should be renewed to the incumbent broadcaster or should be turned over to the new applicant. Sometimes competing applicants withdraw their applications during the comparative process upon the payment of money or other consideration by the licensee. Some question whether this comparative process serves the public interest because capital financing may be less available to broadcasters who face some uncertainty whether their licenses will be renewed. In practice, however, few licenses have been turned over to competing applicants, and the courts have endorsed the idea that a licensed broadcaster has a "renewal expectancy."[24] The FCC recently initiated a second further notice of inquiry and notice of proposed rulemaking intended to eliminate abuses of the renwal process.[25]

The FCC's 1981 radio deregulation order was perhaps the most significant deregulatory action involving television or radio up to that time.[26] It eliminated the need for stations to keep officially prescribed program logs; lifted limits on the amount of time that could be devoted to commercials; eliminated the requirement to ascertain community needs; and eliminated the mandatory quota of news and public affairs programming. The Commission noted that:

> *Today... it has become essential in view of the proliferation of radio stations and other broadcast services that radio licensees specialize to attract an audience so that they may remain financially viable. Consequently, policies that may have been necessary in the early days of radio may not be necessary in an environment where thousands of licensees offer diverse sorts of programming and appeal to all manner of segmented audiences.*[27]

Although some observers believe that radio deregulation has led to overcommercialization and has erroneously shifted to the public the burden for showing a station is not operating in the public interest, most evidence is that radio continues to be a medium enjoying substantial public acceptance and appeal.

Technologies

Satellite technology has boosted the ability of some to establish and operate radio networks ABC, NBC, CBS, and RKO have each operated multiple networks for many years, gearing network formats to fit different types of affiliate programming. These traditional networks which provide news, features, and specific program feeds have been joined by newer 24-hour "format" networks. Also popular are syndicated program services which offer features, comedy, music, and other material from a minute to several hours long, to fit just about any station's format.

Changes in radio services are often prompted by the needs of listeners or advertisers and the opportunities presented by new technology. Many stations have begun using compact digital audio disk players (CDs), which provide extremely high fidelity sound with virtually no wear to the disk. Since their introduction in 1984, CDs have boomed in popularity, especially with radio stations. By 1986, 17 percent of radio stations were using compact disc players on the air. By 1987, that number had almost doubled so that one third of all stations used them on the air.[28] One industry survey showed that among AM/FM combination stations, respondents indicated strong interest or a serious intent to purchase in 1987 the products shown in Table 3 (in order of number of responses).

The same survey asked AM, FM, and AM/FM combination operators to indicate in order their areas of interest in certain technologies.[29] The results of responses to this inquiry are shown in Table 4.

One of the reasons radio has been able to compete effectively with television, cable, cassettes, and other media has been a commitment by most stations to technical improvements. The technologies listed further support that commitment, particularly the prospect of "all digital radio" which could make radio sound even better and permit its transmission over digital wire networks being deployed by telephone companies, coaxial cable companies, and others.[30]

As noted by the National Association of Broadcasters recently, radio stations are "very reliant" upon satellite networks for their programming. About 90 percent of all radio stations have at least one satellite receiving dish[31] with the great majority using them to receive network feeds.[32] Other uses of satellite dishes include receiving advertising messages, data, and news.[33]

Table 3

1. CD players
2. Cart decks[34]
3. Consoles[35]
4. Microphones
5. Test Equipment
6. AM Transmission
7. Business Automation
8. Studio-Transmitter Links (STLs)
9. Studio ATRs[36]
10. Newsroom computers

AM/FM Combination Station Intended Purchases[37]

TABLE 4

AM Respondent Interest		FM Respondent Interest		AM/FM Respondent Interest	
AM Improvement	88%	Cart alternatives	46%	AM improvement	57
Cart alternatives	30	CDs	35	Cart alternatives	37
Telco alternatives[38]	24	Telco alternatives	24	CDs	39
All digital radio	13	All digital radio	22	Telco alternatives	31
CDs	12	Extended SCAs	13	All digital radio	16

Radio Station Operator Interest in Technologies

Searching for ways to utilize the spectrum more efficiently and to facilitate new, potentially minority-owned stations in urban areas, in 1979, the FCC launched a proceeding to examine whether AM stations could operate with 9 kHz channel allocations instead of the established 10 kHz channels.[39] Reduced spacing would have permitted more stations to operate within the AM band, but might also have created certain interference problems. In the course of the FCC proceeding, significant costs were estimated for stations and consumers to convert to 9 kHz AM services and the Commission decided that it was unwise.

About 2,000 AM stations operate as "daytimers," only authorized to broadcast from sunrise to sunset. Such restriction is necessary in order to protect "clear channel" stations from interference. The unique propagation characteristics of AM signals, under certain conditions, cause part of the AM transmission to bounce off the ionosphere at night so that an AM signal can often be heard hundreds of miles away from the transmitter. In its early days, few radio stations were on the air and this "skywave" service was important in providing radio service to as many people as possible. Therefore, about 60 stations were assigned "clear channel" frequencies and authorized to operate 24 hours a day at 50 kw. Today, however, AM daytimer stations argue the "clear channel" stations do not need the same degree of interference protection because there are almost 5,000 stations in the country. On the other hand, clear channel operators claim they provide essential emergency information over their high powered signals. Some daytimers have been granted 24 hour operation on foreign clear channel stations and have been authorized to operate at high power within two hours of sunrise and sunset. The FCC has not taken up any specific issues about limiting the power levels of other clear channel stations, but may deal with the question of protecting skywave service in its omnibus AM improvement docket.[40]

Some AM stations suffer an exceptional type of interference: high powered broadcasts from Cuba to the United States which may interfere with stations as far away from Cuba as Des Moines, Iowa. When Radio Marti began service in 1985 as part of the Voice of America, broadcasting U.S. programming to Cubans, the Cubans retaliated by sporadically jamming certain U.S. AM channels, including 1040 kHz and 1160 kHz. Efforts have been underway between the two governments to reach an agreement to resolve the problem: it was announced last year that they would try to find an AM frequency which could be reserved for Cuban broadcasts intended for U.S. reception.[41] Stations demonstrating financial harm from Cuban interference are able to obtain reimbursement from funds administered by the FCC.

The FCC expanded commercial use of the FM subcarrier (SCA) in 1983[42] and deregulated use of the AM carrier in 1985.[43] These carrier frequencies can carry slow speed voice and data without disrupting the main program. Uses for SCAs and AM carriers include paging, data transmission, utility monitoring, and background music. For example, an electric utility might lease time on an FM SCA to monitor energy needs at substations. Although these uses by AM stations are minimal, SCAs are being used by over 41% of all FM stations for these and other commercial uses.[44] Noncommercial FM stations are increasingly using SCAs as a new source of operating revenues. An industry survey showed that 20% of FM station respondents intend to expand their use of FM SCAs in 1987. The report commented, "SCAs seem to have a firm but ill-defined place in the FM radio industry as technology continues to be developed and used to a certain extent by stations; still this unusually good revenue opportunity remains unexploited, at least to its full potential."[45]

One of the most ambitious FCC attempts to accommodate modern technical improvements was its revamping of FM allocations.[46] Through downgrading stations to newly created intermediate classifications and intermixture of Class B and C channels, the Commission has created opportunities for over 600 new FM stations to be licensed.

In 1979, the World Administrative Radio Conference (WARC) agreed that member countries in the Western Hemisphere would reallocate 1605- 1705 kHz to AM usage. The United States participated in subsequent Regional WARCs to implement this decision. The FCC has initiated a proceeding to consider adoption of domestic rules for the licensing of AM band expansion facilities.[47] Some 200 new stations may be made possible from this expansion, some coming on the air in 1990 or 1991.[48]

Ownership Issues

Increasing minority ownership of broadcast stations has been a longstanding goal of NTIA, the Commission and industry. The Broadcast Capital Fund, Inc. (BROADCAP) was established in 1978 by the National Association of Broadcasters as a private nonprofit venture capital organization to help minorities acquire broadcast stations. Over $11 million has been financed by BROADCAP, affecting 37 radio stations.[49]

In 1978, the FCC extended its "distress sale" policy to encourage the sale of stations to minorities. If a license was designated for hearing in a renewal proceeding, the broadcaster was allowed to sell the station before commencement of the hearing at a "distress sale" price, or no more than 75 percent of fair market value, to a minority purchaser.[50]

Another incentive for increased minority ownership was the FCC's tax certificate policy, permitting a seller to defer capital gains tax upon the sale of a broadcast property to a minority entrepreneur.[51]

The FCC had determined that because women were underrepresented in telecommunications ownership positions that these minority policies and other preferences for minorities should extend to women. In 1987, however, the Federal Circuit Court for the District of Columbia held that the gender preference policy exceeded the FCC's statutory authority.[52] On remand, the Commission undertook a study to determine whether a nexus existed between minority preferences and more diverse programming because of that minority ownership. The Congress subsequently passed legislation prohibiting the Commission from spending any appropriated funds "to repeal, to retroactively apply changes in, or to continue a reexamination" of tax certificates, distress sales, or minority preferences.[53]

In 1982, the Commission eliminated its "antitrafficking" rule, the rule requiring a broadcast licensee to hold the license at least three years before assigning or transferring it.[54] This decision, combined with more lenient ownership limits[55] and other factors, has led to dramatically increased activity in station trading. Although legislation was introduced in the first session of the 100th Congress to require the FCC to reinstate a minimum holding period, further Congressional action is uncertain.

The AM and FM services have provided many more opportunities than television for diverse ownership. Today, although stations in the largest markets remain available to relatively few well financed companies, ownership of radio stations does not pose high entry barriers. Prices for stations vary widely, from hundreds of thousands to multiple millions of dollars. Today, nine or ten times cash flow is a good estimate to ascertain a station's selling price. One broker has noted the increased willingness of commercial lenders to finance station sales, suggesting that

> *"[t]oday you can purchase a $30 million radio group, at ten times cash flow, for approximately seven-and-a-half times cash flow in senior and mezzanine debt (debt of $22,500,000), and equity of*

> *approximately $8.5 million to $9 million, for a 3 to 1 debt to equity ratio...Ten years ago, most radio stations outside the Top 25 markets were acquired by going into your favorite hometown or regional bank and pleading and cajoling for a loan officer to make a 'cash flow' loan."*[56]

Programming

In stark contrast to the print media, a group of statutory provisions and FCC rules regulate the certain content of broadcasts.[57] Because of the proliferation of broadcast stations and other media outlets, the historical "scarcity rationale" underlying FCC content regulation was heavily criticized throughout the 1970s and 1980s. In August, 1987, the FCC declined to enforce the "fairness doctrine,"[58] in a case involving a station in Syracuse, N.Y., finding that the doctrine violated the First Amendment rights of broadcasters.[59] Congressional action may result in codification of the fairness doctrine, however, and in any event, it is believed that the courts will finally determine the constitutionality of the fairness doctrine and other content regulations.

The proliferation of sexually explicit music lyrics and disc jockey comments attracted the attention of Congress, the FCC, and citizens' groups. One group, the Parents Music Resource Group, raised sufficient concern in the Congress to cause the Senate Commerce Committee to hold hearings in 1985. In 1987, the FCC reaffirmed its authority to regulate the broadcast of indecent or obscene transmissions[60] and issued new standards to clarify its enforcement authority.[61] The FCC made clear that it would take enforcement action against indecent language beyond the "seven dirty words" broadcast in a George Carlin monologue which became the subject of a Supreme Court case in 1978.[62]

The relationship between radio broadcasting and the music recording business has been one of symbiosis for many years. Each business has helped popularize the other. Radio is still the most important stimulant to record buying, not only to teenagers but also to those aged 25 and over.[63] The number of ways a consumer can become exposed to new music is increasing with the advent of MTV and other music video channels, but 69 percent of record purchasers surveyed recently said they became aware of the record by hearing it on radio.[64] One expert noted that today CDs and cassettes make up about 70 percent of the market with vinyl record sales accounting for only 30 percent. He said, "by the 1990s, I'll be totally shocked if there are still vinyl records being made."[65]

Although most record, CD, and cassette buyers still make purchases based on radio airplay, other exposure in film, broadcast television, and cable music networks can lead buyers to purchase enough records to boost the likelihood of radio play. Theatrical films commonly feature one or more popular songs and television shows like "Miami Vice" may create a surge in popularity of records. "The Time of My Life," the theme song from a 1987 hit motion picture ("Dirty Dancing") sold about 500,000 units even before the record was widely played on radio.[66]

The copyright "performance rights" for a given sound recording must be obtained by a broadcaster before it can be aired. Composers and their music publishers holding these performance rights have joined together in several music rights societies which act as brokers for clearing the performance rights. Most important in the U.S. are the American Society of Composers and Publishers (ASCAP), Broadcast Music, Inc. (BMI), and the Society of European Songwriters, Authors, and Composers (SESAC).

Most successful radio stations develop unique blends of carefully selected personalities, music, and service, but must keep adjusting their formats to keep pace with listeners' changing tastes. The contemporary hit radio (CHR) format generated top ratings for FM stations in the 1980s. A new format featuring "new age" music combining easy listening jazz music, has recently been syndicated as "The Wave", and may signal an important change in listeners' preferences.

The following chart lists the audience reach of AM and FM stations using various formats in the Spring of 1987.[67]

TABLE 5

Format	National Audience Reach (%)
Adult Contemporary	21.7
Contemporary Hit Radio	18.8
Country	12.9
Album Oriented Rock	11.8
Beautiful Music/Easy Listening	10.0
Urban Contemporary	8.2
News/Talk	5.7
Golden Oldies	4.7
Big Band	1.7
Religious/Contemporary Christian	0.8
Classical	0.7
Miscellaneous	0.6
Alternative Adult	0.2
Jazz	0.1

Audience Reach of AM and FM Stations

Challenges

Methods of measuring listeners continue to be refined. Arbitron and Birch are currently the primary sources of radio ratings information,[68] and are capable of breaking down a station's ratings by specific age, sex, and race demographics within each market. One firm recently announced plans to gather statistics on household income, education, occupation, working women, newspaper readership/TV viewing habits, and product and service consumption habits regarding fast food, airline travel, beverages and more.[69]

The biggest challenges and uncertainties facing radio in 1988 revolve around the future of the AM service. Over the last ten years, a dramatic inversion in audience share has occurred so that today, only three in 10 people listen to AM radio. Those listeners, moreover, are usually over 35.

The sound quality of the AM service is generally inferior to FM for several reasons. First the AM band is more vulnerable to atmospheric interference and noise; second, all kinds of electronic products, from hair dryers to personal computers, emit AM radio waves which interfere with AM broadcast stations; third, AM stations are allocated at 10 kiloHertz intervals, in contrast to FM channel bandwidths of 200 kHz (or 20 times the width of AM channels) which can carry more information, creating higher fidelity sounds; fourth, the widespread practice of "processing" or boosting the higher frequencies of the broadcast signal by AM operators has created excess interference; fifth, in part to compensate for "overprocessing" by broadcasters and also to save manufacturing costs, radio manufacturers are making cheaper AM radios with limited frequency response and reduced bandwidth capability. Compounding these factors is the explosion in the number of stations on the air. Even though many AM stations are losing money, new applicants are still seeking, and being granted, licenses from the FCC.

Recognizing that AM service has diminished in competitiveness, the industry and government have recently taken steps to restore the competitiveness of AM broadcasting. The FCC's Mass Media Bureau released a comprehensive study of all AM regulations in 1986 to begin reexamination of technical, ownership, and other rules which may limit the ability of AM broadcasters to compete with other audio services.[70] In its comments on the report, NTIA voiced the opinion of many that the most immediate and important need of the AM service is to improve fidelity and signal quality. An omnibus FCC proceeding was initiated in 1987 to examine technical assignment criteria including co-channel and adjacent channel interference protection ratios, skywave and groundwave propagation, station classifications and operating authority, and improved antenna systems.[71]

In the 1960s and 1970s, some Commission rules were intended to encourage development of the infant FM service, sometimes at the expense of the AM service. A deliberate decision was made in 1962, for example, to adopt an FM stereo standard, but not to adopt an AM stereo standard, because "[w]e are of the opinion that [FM] is the ideal medium for the full and orderly development of high quality stereophonic broadcasting."[72] As it became apparent in the 1970s that listeners wanted better fidelity, including stereo, the Commission opened an AM stereo proceeding. In 1981, however, the FCC determined not to select one of the five competing AM stereo systems as the industry standard, but left the decision to marketplace forces.[73] Because "stereo" connotes high fidelity to many consumers, NTIA believed that AM receivers must feature stereo in order to heighten consumer interest in better quality AM service. NTIA released two studies on the status of AM stereo in 1987.[74] The first report identified three ways in which compatibility could be achieved between radio receivers and broadcast stations: (1) the government could select one AM stereo system as the industry standard, a possibility which NTIA did not recommend because of the lengthy FCC process and likely court appeal which would ensue; (2) the market could coalesce around one system, making it the de facto single standard, a possibility which NTIA concluded had not occurred; and

(3) the widespread manufacture and distribution of radios capable of receiving both of the systems remaining in competition for the AM stereo market.

The second NTIA report found that although these "multisystem" AM stereo receivers were technically feasible and do not degrade either of the stereo signals, receiver manufacturers are not likely to adopt the technology. Thus, NTIA recommended the FCC conduct a proceeding to protect from interference the pilot tone of the Motorola C-Quam system, the system which has been adopted by more broadcasters and is built into all AM stereo receivers. If other systems, such as the Kahn system, achieve specific thresholds of popularity, they too could be given an FCC "endorsement" of a protected pilot tone.

Another important aspect of AM improvement was successfully addressed in 1986-1987 by a voluntary industry committee, the National Radio Systems Committee (NRSC) initiated by the National Association of Broadcasters and the Electronics Industries Association. The group of about 60 people developed a technical standard for broadcasters to use in adjusting AM processing, or preemphasis levels, and which receiver manufacturers would use in designing the deemphasis function and bandwidth of AM receivers. The success of this group could profoundly improve the sound of AM radio. As one broadcaster put it, "Listeners will hear full-fidelity AM radio for the first time in their lives."[75] The FCC has begun a proceeding to determine whether the NRSC preemphasis standard should be made mandatory for all AM broadcasters.[76]

Some have suggested that the difference in the AM and FM band should be deemphasized. They note that UHF television has been helped by downplaying the differences between the UHF and VHF bands, and urge the industry to build "continuous dial" or "linear" radios that would automatically move between AM and FM without the listener having to shift bands.

There is some evidence that the challenge for AM is not simply technical. A recent study reveals that AM is perceived by most listeners as "top-heavy with news and informational programming, nearly devoid of music, overcommercialized and generally out of step with the times and the things people want from radio." The study recommends that AM broadcasters present more music, especially contemporary music.[77]

Whether sufficient improvements can be made the in AM broadcasting practices and AM radio manufacturing in time for the service to recapture lost audiences remains to be seen. Some AM stations have lost so much value that they are being traded for assumption of debt with no cash.[78] In general, however, the National Association of Broadcasters reports AM stations doing well in terms of cash flow margins, as shown in Table 6.

There are other potential uses of AM frequencies, like slow speed data transmission, which may become attractive alternatives to AM licensees seeking new ways to generate revenue.

The gloomy outlook for AM broadcasting has prompted some to look critically at what is happening to the FM service in view of the tremendous demand for new FM stations. A new FM task force has been created by the National Association of Broadcasters to prevent the "AM-ization" of the FM band. The FM service, according to some engineers, is beginning to be overcrowded and FM broadcasters are beginning to overprocess their signals, much like AM broadcasters during the 1970s and 1980s.

TABLE 6

Station Type	Cash Flow (%)
AM Fulltime	13.3
AM Daytime	15.3
AM/FM	21.8
FM	20.3

Cash Flow Margins -- 1986 Nationwide Averages[79]

One of the goals stated in the Communications Act is to "make available, so far as possible, to all the people of the United States a rapid, efficient, Nationwide and world-wide wire and radio communication service with adequate facilities..."[80] The Commission has historically tried to increase the number of licensees to provide more diversity and to serve greater numbers of people. Implicit in the assignment of licenses by the FCC has been the assumption that the frequency assigned would be clear of interference and the operating parameters of the new licensee would prevent interference to other stations. We may be reaching the point where that assumption may no longer be true for either the AM or FM service.

The large number of radio stations, the wide variation in facilities (authorized hours of operation, power, classes, AM and FM), and wide range of prices create conditions which permit relatively easy, often local, entry. Similarly, local advertising needs and listener habits make radio a particularly strong medium for achieving "localism."

Major Trends

For about twenty years, radio's share of total advertising revenues has held constant at about 7 percent. That share is not expected to change, although the total amount of money spent on advertising continues to grow each year.[81] Moreover, shifts will occur among the portion of local, spot, and national revenues, with greatest growth being achieved by local advertising sales.[82]

The radio business was called "very healthy" recently by a leading industry analyst.[83] Increases in total radio billings have established a predictable and stable pattern. One broadcaster noted that "total [radio] revenues have gone up every year for the past 35 years."[84]

One analyst expected that radio's growth over the next three years will remain in double digits for both networks and stations. Radio station revenues achieved a compound annual growth rate of 10.4 percent over the 1982-86 period according to the firm; they forecast a 10.3 percent compound annual increase in revenues from 1987 through 1991.[85]

In 1986, a record number of radio stations were sold and the value of those transactions reached new highs. One industry analyst estimated that about 16% of all American radio stations changed hands in 1986 at a total value of $3.2 billion.[86] By the end of the third quarter of 1987, station sales amounted to over $2 billion.[87] In contrast, only 9 percent of stations changed hands in 1981, valued at $600 million.[88]

Some investment bankers believe radio station trading is entering a "buyers' market", because some stations purchased at peak prices in the early 1980s are having a hard time servicing their debt and because of the general uncertainty in financial markets in the closing months of 1987. One industry participant identified properties in markets 20 through 120 as meriting special attention in the future. One entrepreneur said in 1986 that "[t]he opportunities for building a major market radio group within the next five years should be greater than at any time in the history of our medium."[89] Even though many mergers have occurred and some large owners have exited the market, many new firms have gotten into radio ownership. Radio and television stocks have "been quietly rising on the ladder of desirable alternative investments."[90] More favorable recognition on Wall Street of media stocks and the increasing asset value of broadcast properties have made commercial borrowing easier.[91] One analyst predicts that station values will not be tied solely to multiples of cash flow, but increasingly will take into account assets, past and projected performance, and local and national market conditions.[92]

The tools used to measure radio stations' performance are expected to remain generally the same, with some improvements in techniques. Some broadcast organizations have tried to initiate improvements in measuring the percentage of minority listeners, exploring the use of meters in measuring radio use, and in increasing competition in the provision of ratings services.[93] A panel of radio industry participants recently agreed that the Arbitron ratings service is likely to remain the primary source for local market buying and that the industry cannot support a third ratings service. Some of these experts also believed that Birch Radio would become more accepted because of its focus on qualitative data about listeners.[94] Arbitron, however, has also announced plans to increase its measure of qualitative data.[95]

One consultant sees radio focusing more and more on the over 25 audience, and believes that the traditional relationship between radio and records may be at some risk because of a shift to older listeners who buy fewer records.[96]

The current trend is for radio stations to rely increasingly on networks for their new programming. Many AM stations and some FM stations are increasing the amount of news they carry. Although there appears no reason for this increase in news on some stations to change, it is possible that the trend towards network news sources may not endure.

Cable television may increase its competitiveness with radio since cable rates are generally comparable with radio.[97] On the other hand, there may be increasing opportunities for cable and radio to work together, as evidenced by a new venture in which the Financial News Network (FNN), a cable network, will produce business news content for radio distribution by the Starstream Communications Group.[98]

The greatest change in radio in the coming years may be a change in the service areas of certain AM stations and, as detailed above, the outcome of efforts to make AM service more competitive with FM and other audio services. One industry observer believes that by 1990, 75 percent of all revenue will be on the FM band and as little as 20 percent of all radio listening will be on the AM band.[99]

Radio receivers will continue to change as technology improves. FMX, a development that strengthens the FM signal helps stations improve their coverage and is being incorporated into more and more FM receivers. Several changes are being made and will be made in AM receivers: stereo capability, the NRSC deemphasis standard, new AM channels at 1605 to 1705 kHz, and continuing tuning which permits a listener to tune any AM or FM channel without manually switching the band.

Radio cannot be eclipsed entirely by other audio services because of its portability and convenience. Although cassettes and compact discs are becoming common in automobiles, the high use of broadcast radio in cars, in walk-along sets, and as a means of waking up in the morning make most industry observers believe that radio is here to stay.

Notes

1. 47 U.S.C. 307(a) (Supp. III 1985)

2. Radio Facts 1986-87, Radio Advertising Bureau, pp. 2-6.

3. Includes noncommercial and commercial stations. Source: Broadcasting/Cablecasting Yearbook 1988.

4. Audience shares are based on commercial ratings service reports. The 1975 and 1985 shares were furnished by James Duncan, publisher of Duncan's American Radio, Kalamazoo, Michigan.

5. Miller, Kaplan, Arase & Co., Los Angeles, CA.

6. Owned by Capital Cities/ABC, they are the Information Network, Direction Network, Entertainment Network, Rock Network, FM Network, and Contemporary Network.

7. "Cap Cities/ABC Said Buying Satellite Music Network", The Pulse of Broadcasting, November 23, 1987, p. 3.

8. "Downside, Upside", Broadcasting, Nov. 16, 1987, p. 7.

9. Westwood One began as a one-man operation headed by Norm Pattiz who launched a radio syndication company in 1975 to distribute "The Sound of Motown." That venture led to other successful barter syndication deals focusing on countdown programs, concerts, interview specials and lifestyle features. By 1980, Westwood One had revenues of $2 million, and by 1983 revenues were $10 million. The company went public in 1984, and raised $40 million for the acquisition of the Mutual Broadcasting Networks. In 1986 $100 million was raised, providing the money for the $50 million purchase of the NBC Radio Networks.

10. Radio Advertising Bureau in Communications Daily, November 27, 1987, p. 7.

11. RadioFacts, 1986-87, Radio Advertising Bureau, 1986.

12. Broadcasting/Cablecasting Yearbook 1987, p. A-2.

13. 1986 Radio Financial Report, National Association of Broadcasters, p. iv.

14. Susan Harrison, Harrison Associates, in American Radio: Tenth Anniversary Issue by James Duncan, Jr., 1986, p. B-29.

15. "Banking on Radio," Sound Management, Vol. 4, No. 10., October 1987, p. 8.

16. "Dimensions of Station Trading," Sound Management, Vol. 4 No. 10, October, 1987, p. 15.

17. James Duncan, Jr., in American Radio: Tenth Anniversary Issue by James Duncan, Jr., 1986, pp. A-14 - A-17.

18. But note the subsequent emergence of "The Wave," described below at p. 11.

19. "The Last Decade (table)," Sound Management, Vol. 4, No. 10, October, 1987, p. 34.

20. National Broadcasting Co. v. United States, 319 U.S. 120 (1943).

21. Amendment of Section 73.3555, 100 F.C.C. 2d 17 (1984), recons. in part, 100 F.C.C. 2d 74 (1985).

22. Notice of Proposed Rule Making, 2 FCC Rcd 1138 (Feb. 20, 1987).

23. Pub. L. 97-35, 95 Stat. 357 (1981).

24. Central Florida Enterprises, Inc. v. FCC, 598 F.2d 37 (D.C. Cir. 1978); National Black Media Coalition v. FCC, 589 F.2d 578 (D.C. Cir. 1978).

25. Public Notice No. DC-1186, Action in Docket Case (BC Docket 81-742), (Jun. 23, 1988).

26. Report and Order, Deregulation of Order, 84 F.C.C. 2d 968, (1981), aff'd sub nom., United Church of Christ v. FCC, 707 F.2d 1413 (D.C. Cir. 1983).

27. Id. at 969.

28. Targeting Radio's Future, The National Association of Broadcasters, 1987, p. 52.

29. The percentage of responses may add up to more than 100 since more than one response could be selected. Data from "1987 Survey of Industry Needs", Id.

30. "Digital Radio: Will the Public Pay to Listen," Washington Post, July 28, 1988, E3.

31. Targeting Radio's Future, The National Association of Broadcasters, 1987, p. A-16.

32. Id. at A-23.

33. Id.

34. Tape machines used to play recorded commercials.

35. Control boards.

36. Audio Tape Recorders (production equipment)

37. "1987 Survey of Industry Needs" by Tim Wetmore, Broadcast Management/Engineering, February 1987, p.67, at 81.

38. Expenses for special telephone service connecting studios and transmitters have increased substantially, causing broadcasters to explore alternative service options.

39. Notice of Inquiry, BC Docket 79-164 (FCC 79-365), adopted June 21, 1979, 44 Fed. Reg. 39550 (July 6, 1979).

40. Public Notice AM Broadcast Rules, Major Review, 2 FCC Rcd. 3705; Notice of Inquiry Review of Technical Assignment Criteria for the AM Broadcast Service, 2 FCC Rcd. 5014.

41. "U.S.-Cuba Move to Resolve AM Interference Problem", Broadcasting, November 30, 1987, p. 114.

42. First Report and Order, BC Docket 82-536, FCC 83-154, adopted April 7, 1983; Second Report and Order, FCC 84-113, adopted April 26, 1984 (1984); Report and Order, MM Docket 83-1322, FCC 84-301, adopted June 27, 1984 (1984); Memorandum Opinion and Order, BC Docket 82-536, FCC 84-531, released January 25, 1985.

43. In the Matter of Eliminating Restrictions on AM Carriers, 100 F.C.C. 2d 5 (1985).

44. "Targeting Radio's Future," The National Association of Broadcasters. NAB's figures indicate an increase to current levels in SCA usage from 33% of FM licensees in 1985.

45. "1987 Survey of Industry Needs", by Tim Wetmore, Broadcast Management/Equipment, February, 1987, p. 67, at 74.

46. Notice of Proposed Rulemaking, BC Docket 80-90 (FCC 80-108), adopted February 28, 1980, 78 F.C.C. 2d 1235 (1980). Report and Order, FCC 83-259, adopted May 26, 1983, 94 F.C.C. 2d 152 (1983); First Report and Order, MM Docket 84-231, adopted December 19, 1984, 57 R.R. 2d 863

(1985); Second Report and Order, FCC 85-124, adopted March 14, 1985, 50 Fed. Reg. 15,558 (April 19, 1985).

47. Third Notice of Inquiry in Gen. Docket No. 84-467 (FCC 87-212), released July 16, 1987.

48. Targeting Radio's Future, The National Association of Broadcasters, 1987, p. 72.

49. "BROADCAP Finances Two New Minority Owners for Pending Radio Properties", The Pulse of Broadcasting, October 19, 1987, p. 4.

50. Statement of Policy on Minority Ownership of Broadcasting Facilities, 68 FCC 2d 979 (1981). The distress sale policy became available to minorities who invested in limited partnerships, so long as the minority owned at least 20 percent of the partnership's assets and exercised managerial control. Policy Statement and Notice of Proposed Rule Making in Gen. Docket 82-797, 48 Fed. Reg. 5976 (February 9, 1983).

51. Section 1071 of the Internal Revenue Code. See also First Report and Order in Docket No. 18110, 22 FCC 2d 306; Second Report and Order in Docket No. 18110, 50 FCC 2d 1085 (1975); Public Notice (FCC 76-337) 59 FCC 2d 91 (1976).

52. Steele v. FCC, 770 F.2d 1192 (D.C. Cir. 1985), remanded en banc, 806 F.2d 1126 (1986).

53. H.R. 4782, 134 Cong. Rec. S9885, S9894 (daily ed. Jul. 26, 1988); H.J. Res. 395, Pub. L. No. 100-202, 100 Stat. 1329 (1987), 133 Cong. Rec. H12392, H12401 (daily ed. Dec. 21, 1987).

54. Transfer of Broadcast Facilities, 52 R.R.2d (P & F) 1081 (1982), modified, 99 F.C.C. 2d 971 (1985).

55. See discussion supra at 12.

56. Tom Gammon, Dan Gammon, Craig Culp, in American Radio: Tenth Anniversary Issue by James Duncan, Jr., 1986, pp. B-34-35.

57. See, e.g., 315 Communications Act, 47 U.S.C. 315; 47 C.F.R. 73.1920, "personal attacks"; 47 C.F.R. 73.1930, "political editorials".

58. The requirement is that radio and television broadcasters must address issues of controversy in their communities and, when doing so, must air "contrasting points of view." 47 C.F.R. 73.1910 (1986).

59 *Syracuse Peace Council*, 59 R.R. 2d (P&F) 179 (1985), *remanded sub nom.*, *Meredith Corp. v. FCC*, 809 F.2d 863 (D.C. Cir. 1987); *Order Requesting Comment*, FCC 87-33, 2 FCC Rcd 794 (1987) (remand proceeding); *TRAC v. FCC*, 801 F.2d 501, *rehearing denied*, 806 F.2d 1115 (D.C. Cir. 1986); *Notice of Inquiry* in MM Docket No. 87-26, 2 FCC Rcd 1532 (1987)

60. 18 U.S.C. 1464; 47 U.S.C. 312, 503.

61. *Memorandum Opinion and Order* (FCC 87-141), adopted April 16, 1987; *Public Notice*, FCC 87-153, April 29, 1987.

62. *Pacifica Foundation*, 56 F.C.C.2d 94 (1975), *recons. in part*, 59 F.C.C.2d 892 (1976), *rev'd sub nom.*, *Pacifica Foundation v. FCC*, 556 F.2d 9 (D.C. Cir. 1977), *rev'd*, 438 U.S. 726 (1978).

63. "Baby Boomers Big Buyers", *Radio and Records*, September 11, 1987, p. 74.

64. Mike Shalett, "Motivating Consumers", *Radio and Records*, November 6, 1987, p. 40.

65. "An Overview of the Record Industry and How It Relates with Radio", with Eddie Mascolo, Senior VP, Product Development, RCA Records, *The Pulse of Broadcasting*, December 14, 1987, p. 15.

66. *Id.*

67. Data from *Radio & Records Ratings Report*, Special Supplement, Fall, 1987, p. 4.

68. Over the last thirty years, other rating services have come and gone, including Nielsen, DFS "Pulse", Audits and Surveys and Burke International. In addition, RADAR, a part of Statistical Research, Inc. (SRI), is a popular network radio rating service.

69. The survey research devoted to buying habits of different types of individuals is known as "psychographics." "Birch Adds Lifestyle and other Qualitative Data To Its Quarterly Reports", *The Pulse of Broadcasting*, September 7, 1987, p. 5.

70. *Report on the Status of the AM Broadcast Rules*, Submitted to the Federal Communications Commission by the Staff of the Mass Media Bureau, April 3, 1986.

71. Public Notice AM Broadcast Rules, Major Review, 2 FCC Rcd. 3705 (1/15/87); Notice of Inquiry Review of Technical Assignment Criteria for the AM Broadcast Service, 2 FCC Rcd. 5014 (8/17/87).

72. Memorandum Opinion and Order, FCC 62-68, adopted January 10, 1962, 21 R.R. 1616(a), 1616(e) (1962).

73. Report and Order, Docket 21313 (FCC 82-111), adopted March 4, 1982, 47 Fed. Reg. 13152 (March 29, 1982). See Meyer, The FCC and AM stereo: A Deregulatory Breach of Duty, 133 U. Pa. L. Rev. 265 (1984).

74. AM Stereo and the Future of AM Radio, National Telecommunications and Information Administration, February, 1987; AM Stereo and Multisystem Compatibility, August, 1987.

75. "The Sound of High Fidelity Goes to the Rescue of AM Radio", The New York Times, April 1, 1987, p. D8.

76. July 21, 1988.

77. Conducted by Steven Apel through the Annenberg School of Communications, reported in "AM's problems more content oriented than technical?" Television/Radio Age, December 28, 1987, p. 70.

78. NTIA reviewed sales transactions of AM and FM stations from 1975 to 1985 which revealed several instances where AM stations were sold for assumption of debt. When adjusted for inflation, all AM stations experienced a negative average growth rate over the 10 year period. Sales of FM stations, on the other hand, experienced strong growth, with an inflation-adjusted average yearly growth rate of 9.47 percent.

79. Cash flow is defined as pre-tax profits plus depreciation, amortization, and interest expenses. Targeting Radio's Future, The National Association of Broadcasters, 1987, p. 73, using data from the 1987 NAB/BFM Radio Financial Report.

80. 47 U.S.C. Sec. 151.

81. Targeting Radio's Future, The National Association of Broadcasters, 1987, p. 89.

82. Id.

83. Paul Kagan cited in "Kagan Advises Caution, But Not Panic For Radio Future", Radio and Records, November 6, 1987, p. 12.

84. "Radio Executives Look Ahead to 1988", Broadcasting, November 23, 1987, p. 44.

85. Veronis, Suhler & Associates, "Cable Growth Accelerates", Broadcasting, November 30, 1987, p. 94.

86. Bruce Cheen, quoted in "Kagan Advises Caution, But Not Panic for Radio Future", Radio and Records, November 6, 1987, p. 12.

87. Radio and Records, September 11, 1987, p. 16.

88. Cheen, supra.

89. Jeff Smulyan, President, Emmis Broadcasting, in American Radio: Tenth Anniversary Issue by James Duncan, Jr., 1986, p. B-2.

90. Paul Kagan, in American Radio: Tenth Anniversay Issue by James Duncan, Jr., 1986, p. B-7.

91. Chesley Maddox, AmeriTrust, in American Radio: Tenth Anniversay Issue by James Duncan, Jr., 1986, p. B-20-24.

92. Susan Harrison in American Radio: Tenth Anniversary Issue by James Duncan, Jr., 1986, p. B-29-32.

93. Targeting Radio's Future, The National Association of Broadcasters, pp. 98-103.

94. "Radio Executives Look Ahead to 1988", Broadcasting, November 23, 1987, pp. 44-45.

95. "ARB Plans New Listening Quality Radio Measures", Variety, November 25, 1987, p. 93.

96. Interview with George Burns, The Pulse of Broadcasting, November 30, 1987, at 10.

97. See also Roger Turner, in American Radio: Tenth Anniversary Issue by James Duncan, Jr., 1986, pp. B-207-209.

98. "Cable news service teams with radio programing firm for business radio network," Broadcasting, March 7, 1988, p. 72.

99. Interview with James Duncan, The Pulse of Broadcasting, December 22, 1986, p. 8 at 9.

XIII Cable Television

by David H. Krech
and NTIA Staff

Cable television is a distribution system through which video entertainment programming, and some data and interactive services, are provided to homes via coaxial cable. As with other new industries, cable television's history is one of continuing growth and change. Early cable systems developed as a means by which local broadcast signals could be delivered to areas either unserved by broadcast television or areas afflicted with poor reception. This service was made feasible by the construction of a master antenna on a nearby hill where the captured signals would be "cleaned up," amplified, and then retransmitted along coaxial cable to the local residents below. Cable operators soon discovered, however, that viewers might value additional viewing options and thus began to "import" broadcast signals from nearby markets and, later from more distant markets with the aid of a common carrier's microwave system.

The cable industry experienced rapid growth in the later part of the 1970s. This growth was made possible by two important developments -- the development of distribution technologies designed specifically to transmit television programming to cable systems (e.g., terrestrial microwave systems, domestic satellites) and the legislative, regulatory, and judicial decisions which allowed cable operators to offer viewers an increasingly diverse menu of alternative program options. These developments made it possible for cable systems to routinely offer, in addition to local and distant signal transmission, a wide variety of programming made exclusively for cable television, including commercial-free premium programming for an additional per-channel charge.

We are currently in a new phase in the evolution of cable television. More than 80 percent of the television households in the United States have access to cable television and more than half of all households subscribe,[1] although a major exception exists where substantial delay has resulted from the local franchise process. In order to sustain its previous rate of growth, cable television must improve its ability to sell cable to households which have so far chosen not to subscribe.[2]

One solution is to offer more and better programming. To this end, the industry has begun to acquire and produce cable-exclusive programming. One cable executive has projected that cable will "triple its present annual expenditures on programming [from $2 billion per year currently] to $6 billion by the end of this decade."[3] Another solution is for cable systems to expand beyond video programming to offer a variety of electronic interactive services, such as electronic shopping, electronic mail, videotext, and security alarm service. Thus, such services are currently being offered by newly constructed and newly upgraded cable systems.[4]

Key Industry Statistics

The typical cable system has three basic components: (1) a "headend" where video and audio signals are received, processed, and prepared for transmission to subscribers; (2) a distribution plant to carry those signals; and (3) subscriber interface equipment which renders the signals transmitted receivable by standard television sets.[7] Locally broadcast signals are received at the headend via antennae, while more distant broadcast signals and cable programming arrive via satellite or microwave links. When received, the signals are fed into processing equipment which adjusts and amplifies the aural and visual components of those signals. Additional information is generated to control the operation of the amplifiers in the distribution plant. The programming and control signals are then combined and fed onto the distribution system.

The cable distribution system is installed underground or, more commonly, on poles leased from local electric or telephone utilities. The system is typically configured like a tree, with the headend as the roots. From the headend, large trunk cables, designed to minimize signal attenuation, or loss, carry signals to the heart of the service area. Branching off these trunks, smaller feeder cables run down streets past the various houses. Finally, drop wires connect each subscribing household to the nearest feeder cable.

Since signals lose strength as they pass through the distribution system, amplifiers must be inserted into the system at certain intervals. Because each amplifier introduces both noise and distortion to the signals transmitted, when amplifiers are "cascaded," or placed in series along a span of cable, noise and distortion will increase as a signal passes through each successive amplifier. As a result, it is necessary to limit the number of amplifiers cascaded in a cable span to ensure a satisfactory signal at the subscriber's premises. Current cable systems have as many as 30 cascaded amplifiers, although modern low noise and distortion equipment makes even larger cascades possible.

Although cable systems are designed primarily for one-way delivery of video programming from the headend to subscribing households, many systems are capable of two-way transmissions, though few systems are actively exploiting that capability. Two-way cable systems are generally asymmetric in that there is much more channel capacity in the direction of subscribers ("downstream") than towards the headend ("upstream"). Such systems also require amplification of signals moving upstream, as well as filters to separate signals moving in either direction.

Three pieces of equipment are commonly found on the subscriber's premises, located between the drop cable and the subscriber's television set. A device called a Balun transformer is often connected to the end of the drop wire, and matches the electrical characteristics of the cable and the home receiver. Many homes also have set-top converter boxes, which descramble premium (i.e., pay) programming and allow more than 12 channels to be received by the television set. Finally, devices called "traps" are frequently used to prevent subscribers from viewing premium programming for which they have not paid.

Today, more than 8500 cable systems provide service to more than 45 million American households.[6] Table 1 depicts the growth in systems, subscribers,[7] and penetration since 1970:

TABLE 1[8]
Growth in Systems, Subscribers, and Penetration since 1970

Year	Systems	Subscribers (000)	Households Served (%)
1987	8,500	44,971	50.5
1986	7,900	42,237	48.1
1985	7,500	39,873	46.2
1984	6,600	37,291	43.7
1983	6,200	33,794	40.5
1982	5,600	29,341	35.0
1981	4,825	23,219	28.3
1980	4,375	17,671	22.6
1975	3,681	9,197	13.2
1970	2,639	4,498	7.5

Early cable systems were generally provided only 12 or fewer channels of programming. In recent years, improvements in transmission equipment have enabled operators to construct higher capacity systems. Operators have been encouraged to do so by a steady increase in programming and customer demand for cable service. The results have been dramatic. In 1971, for example, 95 percent of all cable systems had 12 channels or less.[9] By 1988, more than 50 percent of all systems offered at least 30 channels. Roughly 80 percent of all cable subscribers were served by systems with 30 channels or more.[10] Table 2 depicts the changes in channel capacity between 1983 and 1988:

Table 2[11]
Changes in Channel Capacity Between 1983 and 1988

	1988		1983	
Channel Capacity	Percent of Systems	Percent of Subscribers	Percent of Systems	Percent of Subscribers
54 & Over	7.5	18.2	3.2	4.1
30 - 53	43.5	63.2	25.1	44.6
20 - 29	16.3	11.7	17.7	23.5
13 - 19	4.0	1.0	4.6	4.2
6 - 12	17.2	4.2	39.9	21.7
5	0.4	0.03	1.3	0.1
Less than 5	0.1	0.01	0.2	0.01
N/A	11.0	1.8	8.1	1.8

Cable television developed initially as a means of improving service in areas, predominantly rural, where over-the-air reception was unsatisfactory. As more and more programming services became available, cable television became less of an "antenna" service and more a vehicle for providing additional programming choices to subscribers. As a result, cable systems began springing up even in urban and suburban areas where over-the-air reception was inadequate. This trend is reflected in the steady growth in systems serving large numbers of subscribers. Table 3 depicts the changing distribution of cable systems according to system size between 1983 and 1988:

Table 3[12]
Changing Distribution of Cable Systems

	1988		1983	
Size of System by Subscribers	Percent of Systems	Percent of Subscribers	Percent of Systems	Percent of Subscribers
50,000 & Over	1.8	32.3	1.0	16.6
20,000 & Over	4.3	26.4	4.2	27.0
10,000-19,999	5.8	16.0	6.4	19.4
5,000-9,999	7.3	10.2	9.6	14.9
3,500-4,999	4.8	4.0	7.0	6.4
1,000-3,499	19.2	7.5	27.4	11.5
500-999	13.9	2.0	17.2	2.7
250-499	14.1	1.0	14.7	1.2
249 & Under	20.9	0.6	10.6	0.3
N/A	8.1	---	1.9	---

Table 4 provides cable industry revenues (in millions of dollars) for the last ten years, as well as projected revenues for 1988:

Table 4[13]

Cable Industry Revenues ($ Millions)

Year	Advertising	Basic Svc	Pay Svc	Installation	Total
1988	1,396	7,355	3,804	237.9	12,791.9
1987	1,142	6,416	3,736	227.7	11,551.7
1986	930	5,436	3,806	219.2	10,391.2
1985	751	4,672	3,787	207.0	9,417.0
1984	572	3,878	3,410	134.0	7,994.0
1983	353	3,266	2,787	107.0	6,513.0
1982	227	2,658	2,081	90.0	5,056.0
1981	122	2,124	1,336	67.0	3,649.0
1980	58	1,649	785	39.0	2,531.0
1979	N/A	1,355	435	26.0	1,816.0
1978	N/A	1,167	239	19.0	1,425.0

Although much of the increase in cable revenues over the last decade can be attributed to the growth of pay cable services, 1987 marked the reemergence of basic cable services as the revenue growth center for the industry. This is largely attributable to the fact that the Cable Communications Policy Act of 1984[14] virtually eliminated state rate regulation of basic service. Pursuant to implementing regulations promulgated by the FCC, states may regulate basic cable service rates only in communities which receive fewer than three over-the-air broadcast signals.[15] As a result of this change, approximately 85 percent of all cable subscribers are served by deregulated cable systems.[16] Basic service revenues will most assuredly rise as cable operators increase basic rates from their artificially low levels to more market-driven levels.

While basic service revenues should increase in the near future, pay service revenues appear to be leveling off. Although pay revenues have grown more than fourteen-fold since 1978, average annual growth rates have steadily diminished. Indeed, as Table 4 indicates, pay service revenues actually declined between 1986 and 1987, and are projected to recover only modestly in 1988.[17] This leveling off may be due, in part, to the surge in videocassette rentals. Cable operators have begun to lower pay service rates in an effort to counteract the softness in the cable market.[18] Moreover, a number of premium cable networks (i.e., HBO, Showtime) have attempted to curb dissatisfaction with premium cable service by entering into exclusive dealing arrangements with movie studios. These agreements will reduce the amount of program duplication that appears on the premium cable networks and, in so doing, may stimulate demand for premium service.

In addition to basic and premium services, two potentially important sources of revenues for cable television in the future are advertising and pay-per-view. While representing only 11 percent of the industry's total revenue in 1987, these three areas are far and away the fastest growing sources of revenues for the cable business today. The advertising revenues appearing in Table 4 are derived from the sale of time by cable television networks (e.g., ESPN, MTV, CNN), as well as by cable operators. In 1987, cable operators sold some $271 million in national and spot advertising, up 39 percent from the previous year, and up more than 3000 percent since 1980.[19] Cable networks garnered $867 million in advertising revenues in 1987, an 18 percent increase from 1986 and a seventeen fold increase from 1980.[20]

The growth in advertising revenues for both the cable operator and the cable television network will likely continue as the ability to measure the viewing habits of cable viewers improves. Furthermore, cable operators are making cable television a more desirable medium through which to advertise by offering the advertiser larger audiences through "interconnecting" agreements with other cable operators. These agreements which also permit cable operators to share programming, will likely enhance advertising revenues for both the cable operator and the cable networks.

Pay-per-view service permits a cable subscriber to view, for a flat fee, theatrical releases "on demand." A subscriber can view a pay-per-view program either by making a telephone call or, if the cable system is interactive, via the system itself. Although initially limited to motion pictures, pay-per-view has recently expended to include sporting events, such as wrestling and boxing.[21] Introduced about four years ago, there are four pay-per-view services currently available. Pay-per-view revenues for the industry were some $71 million in 1987, up more than 90 percent from the previous year.[22] And home shopping, which began in 1984, contributed $39 million in direct revenues to cable operators offering it.

The acquisition market for cable systems has been extremely active in recent years. In 1986 alone, over 7 million subscribers, representing approximately 18 percent of all cable households saw the ownership of their cable system change hands.[23] Cable systems now routinely command prices averaging more than $2,000 per subscriber (or about 12 times a systems' cash flow), a 20 percent increase from 1984.[24] For the most part, cable acquisitions have been conducted by players already in the industry. While industry giants Tele-Communications Inc. ("TCI") and American Television and Communications Corp. ("ATC") have added significantly to their subscriber bases, new entrants like Jack Kent Cooke and the Bass family of Texas have also invested heavily in the purchase of cable properties. A major reason for the growth in cable deals is the realization that cable has emerged from its intensive system-construction period into a period in which operating expenses will show only moderate growth and revenues should increase dramatically.

The financial status of cable networks has improved markedly, with many networks becoming profitable for the first time. Arts and Entertainment, Lifetime, the Cable Health Network, and the Weather Channel all emerged from red-ink status in the latter part of 1986. Analysts project that the largest cable network, ESPN, will have pretax profits of $100 million in 1988, a healthy increase from its 1987 profits of $60 million.[25] In addition to achieving financial stability, some of the cable networks are making it very clear that they will now and in the future be major participants in the program acquisition market. ESPN has recently paid $153 million for exclusive performance rights to 13 National Football League games during the 1987-88 season. More recently, the Turner Broadcasting System Inc. has announced plans to create a cable channel that would purchase exclusive rights to such sports attractions as the Wimbledon tennis tournament, the Masters golf tournament, and the Olympics.[26]

The marked improvement in the financial health of the cable networks is attributable to the increase in the number of cable subscribers. The growth in the number of cable subscribers was, in part, a result of the industry's attempt to differentiate itself from broadcast television service. To this end, the cable industry has begun to increasingly rely on cable-exclusive programming. One particularly important area in which the cable industry has begun to acquire exclusive performance rights is in the area of sports. Twenty-two cable systems have their own regional, cable exclusive sports and entertainment channel featuring professional and collegiate sports.[27] Today, the cable industry spends $2 billion on programming, and projections are that this will increase to $6 billion by the end of this decade.[28]

Critical Industry Developments

Regulatory History of Cable Television

Cable television developed in the post World War II period as a means of bringing television service to areas in mountainous regions, where over-the-air signals were not readily receivable. At that time cable television, then known as community antenna television or CATV, was generally not perceived of as a threat by broadcasters, but merely a convenient way to extend their coverage. Regulation of cable was limited to local control over use of the public rights-of-way by the cable system.

It was not until the mid-Fifties that the federal government was asked to regulate cable. In 1956 a group of broadcasters petitioned the Federal Communications Commission ("FCC") to find that cable systems are common carriers and to assert jurisdiction over them based on Title II of the Communications Act.[29] The FCC, however, found that provision of cable service was not common carriage under the Communications Act.[30] In addition, the FCC concluded that cable was not a broadcast service either, and refused to assert jurisdiction over it.[31]

Immediately following its holding in Frontier Broadcasting, the FCC initiated a proceeding to examine the impact of "auxiliary services," particularly cable television, on local broadcasting.[32] Broadcast groups contended in the proceeding that the importation of distant signals by cable systems was adversely affecting local broadcasting and thus the FCC should regulate cable. The FCC, however, reaffirmed its decision in Frontier Broadcasting that it did not have authority to regulate cable as a common carrier or broadcaster.[33] In addition, the FCC held that section 325 of the Communications Act did not protect broadcasters' signals from retransmission by a cable system.[34] Finally, the FCC found that it did not have enough evidence to conclude that importation of signals by cable systems harmed local broadcasting, so it continued to refuse to assert jurisdiction over cable.[35]

Having lost before both the FCC and the Congress,[36] the broadcasters took their case to the courts. Their initial approach was to seek control over the use of their broadcast signals, but this was rebuffed by the courts.[37] A lower court did rule that broadcasters had rights over the showing of their programming in the local area.[38] This victory was short-lived, however, as the appellate court reversed the decision, holding that a broadcaster had no such rights unless it could demonstrate a protectable interest under the copyright laws or avail itself of some other recognized exception to the policy promoting free access to all matter in the public domain.[39]

While those cases were working their way through the courts, the FCC began to have a change-of-heart about regulating cable. In 1962, the FCC, in a reversal of its previous findings, concluded that the importation of a distant signal was having an adverse economic effect on a local broadcast station.[40] It thus denied a license for a microwave system to import television signals to a cable system as not being in the public interest. This marked the beginning of comprehensive cable regulation, for later that same year the FCC proposed to require cable systems using microwave links to carry all local television stations and to protect their programming from duplication on distant signals.[41] Around that same time many local governments began asserting jurisdiction over cable systems through franchising requirements.

In 1965, the FCC adopted its first rules regulating cable television.[42] The FCC claimed jurisdiction over cable based on the effects that cable television had on the system of local broadcast television established by the FCC. The rules required microwave-served cable systems to carry the signals of all local stations, and not to carry duplicating programming on other, distant signals for 15 days before or after such programming was shown on the local stations. The original rules applied only to microwave-served cable systems, but at the same time the rules were adopted the FCC proposed to extend them to all cable systems.[43] The next year the FCC made all cable systems, whether or not they used microwave links, subject to its rules.[44]

There were three basic regulations placed on cable systems in the FCC's original cable rules. First, a cable system had to carry all of the television stations which placed a Grade B contour over the cable community -- the original must carry rule. Second, a cable system could not show a program on a distant signal on the same day it was presented on a local station. Third, limitations were placed on the importation of signals.[45] The FCC premised its authority to regulate cable on the adverse effects cable might have on local television broadcasting.[46]

While the FCC was unable to get Congress to give it explicit authority over cable,[47] it did get the courts to uphold its ancillary authority. In a challenge to the distant signal rules, the Supreme Court upheld the FCC's cable rules. In *United States v. Southwestern Cable Co.*,[48] the court found that the Communications Act of 1934 granted the FCC the authority to regulate cable ancillary to its authority over broadcasting -- the so-called "ancillary jurisdiction."

After the Court's affirmation of the FCC's authority over cable, the FCC began an inquiry on the long-range development of cable, and the need for rules to guide cable's growth. The initial step in the inquiry was to place a "freeze" on distant signal importation until new rules could be developed.[49] The first rules adopted under this proceeding established program origination requirements for cable systems with 3,500 or more subscribers.[50] The second phase was to place ownership limitations on cable. In its *Second Report and Order* the FCC proclaimed that television networks could not control cable systems, nor could a television station have an ownership interest in a cable system within the station's Grade B contour.[51] In the same period, but in another proceeding, the FCC held that telephone companies could not operate cable systems in their local service areas.[52]

Finally, in August 1971, the Commission outlined its proposed cable regulations in a letter to Congress.[53] Following the release of the letter there were intensive negotiations by the affected parties -- cable interests, broadcasters, and copyright owners -- under the leadership of the Office of Telecommunications Policy. In November 1971 a consensus was reached on how cable was to be regulated. Under the Consensus Agreement (1) limited importation of distant signals was permitted (the extent of which was determined by the market size of the cable community), (2) cable systems were required to carry all local and significantly viewed broadcast stations, and (3) syndicated exclusivity was established.[54] In addition, all parties agreed to support a compulsory license for secondary retransmissions by cable systems.

In the Report and Order adopting the rules developed in the Consensus Agreement, the FCC also established numerous other regulations for cable.[55] Included in these rules were standards for the franchising of cable systems by local governments. For instance, the FCC limited the franchise fee that local governments could charge to three percent of gross subscriber revenues, five percent with a special showing. The rules also required cable systems to get certificates of compliance to begin construction. Cable systems located in major television markets had to have a minimum capacity of 20 channels, have capability of two-way communication, and provide access channels and facilities for that use. The rules also maintained the program origination requirements adopted in 1969.[56] Technical standards for cable systems were also established. This marked the high-water point of cable regulation.

In its continuing effort to protect local broadcasting from cable television, the FCC adopted a series of regulations concerning premium cable service in 1975.[57] The FCC was concerned that cable would harm broadcasting by "siphoning" popular programming -- feature films and sporting events -- away from broadcast television and onto premium cable services. To prevent this, the FCC restricted the sports programming that could be shown by premium cable services, and limited these services to showing movies only within three years after release (or after ten years from release if they had not been shown on broadcast television within three years). This time, however, the courts found that the FCC had gone beyond their ancillary authority to regulate cable, and overturned the rules.[58]

That same year, 1977, the FCC began to deregulate cable. The first action it took was to greatly lessen its regulation of franchising by local governments.[59] It also undertook a detailed inquiry into the economic relationship between cable television and television broadcasting.[60] When the inquiry was completed, two years later, the FCC found that the impact of deregulation of cable on broadcasting would be negligible, and that the public would be better off due to increased viewing options from the greater availability of expanded cable services.[61] Based on these findings, the FCC eliminated the syndicated exclusivity and distant signal rules.[62]

During this period the courts also helped further cable deregulation by finding, once again, that the FCC had exceeded its ancillary authority over cable. This time the Supreme Court struck down the minimum channel capacity and leased access requirements as beyond the FCC's authority.[63]

In 1984 the Congress finally gave the FCC explicit authority over cable. In the Cable Communications Policy Act of 1984 Congress established, for the first time, a national policy for cable television.[64] The Act placed reliance on the franchising process as the primary means of regulating cable. It established national, uniform procedures for franchising and renewals in order to encourage the growth and development of cable and to assure that cable systems are responsive to the needs and interests of their communities.[65] Under the terms of the Act cable systems may be required to provide access channels for public, educational and government use and also to provide leased access channels.[66] Franchise fees are limited to 5 percent of gross revenues,[67] and cable systems are free from rate regulation, unless the system does not face "effective competition."[68] The Act also codified the FCC cross-ownership rules -- prohibiting ownership of a cable system by a local telephone company or a broadcast station which places a Grade B contour over the cable community[69] -- and formally extended equal employment opportunity requirements to cable.[70]

Cable television was further deregulated the following year when the courts overturned the must carry rules. These rules, originally part of the FCC's initial cable regulations adopted in 1965 -- required a cable system to carry all local or significantly viewed broadcast stations, up to the channel capacity of the system. Upon review the appellate court held the rules needlessly impinged on the editorial discretion of the cable operator and thus violated the First Amendment.[71] The court found that the FCC had never proven that cable television harmed local broadcasting, and thus had not demonstrated a substantial government interest in the rules. In any event, the rules were held to be excessive. The FCC crafted new, less stringent must carry rules,[72] but these were also found to violate the First Amendment.[73]

Recently, numerous challenges have also been made on the franchising system. Several of these challenges have dealt with the constitutionality of the practice of local governments allowing only one cable system per geographic area. In City of Los Angeles v. Preferred Communications, Inc.,[74] the Supreme Court upheld these types of challenges, and remanded the case for a trial on the facts.

Currently the FCC regulates several aspects of cable television operations, such as: cross-ownership;[75] technical standards;[76] use of aeronautical frequencies;[77] signal leakage,[78] cable television relay service;[79] origination cablecasting,[80] lotteries;[81] sports program blackouts;[82] network program nonduplication;[83] record keeping and reporting;[84] and, equal employment opportunity.[85]

Effects of Deregulation

The dramatic growth of cable television over the last decade was made possible by the removal of federal regulations designed to protect local broadcasters from actual or potential competition from cable television.[86] The Federal Communications Commission's basic concern was the preservation of local broadcast service. The Commission felt that broadcasters would sustain financial injury if cable systems caused local stations to lose audience share and thus advertising revenue, thereby threatening the stations' ability to provide local broadcast service.[87] With this as a basis, the Commission proceeded to adopt from 1966 to 1972, a complex set of rules restricting the programming that cable operators could offer their subscribers. The most burdensome of these rules were the restrictions severely limiting the type of programming that could be offered by premium cable networks, and rules which restricted the number of distant signals that could be imported into the larger broadcast markets.[88]

The Commission's rules were severely criticized. Primary among the criticisms was the charge that the chief beneficiaries of these rules were not the program viewer but the broadcast television networks.[89] Many of the rules, however, were eliminated or curtailed in the years that followed, resulting in a veritable explosion of programming made exclusively for cable. In 1975, Home Box Office (HBO) began delivering commercial uninterrupted programming via satellite to cable systems throughout the United States. Premium cable has become an unqualified success. It has contributed more to the growth in cable television than any other non-broadcast programming service.

During the late 1970s, the Commission authorized the use of 4.5 meter satellite earth stations.[90] Cable operators quickly replaced their 9 meter dishes with the smaller, more cost-effective ones and, in so doing, created an environment conducive to the development of non-broadcast services. Aided by the launching of satellites designed specifically to transmit television programming to cable systems, the development of non-broadcast services went into high-gear in the late 1970s and early 1980s. These non-broadcast services (e.g., ESPN, CNN, MTV, C-SPAN), commonly referred to as "Cable Networks," today constitute an important part of the programming menu offered by cable operators. Today, the top 15 cable networks currently serve, on average, 32 million subscribers.[91] The most popular cable network, ESPN, provides sports, business and news programming to nearly 44 million subscribers.[92]

And, finally, the relaxation of rules governing signal importation, combined with technological developments, led to the development of advertiser-supporter "Superstations." Superstations are distant television stations whose signals are distributed to cable systems through the use of communications satellites. Today there are more than 18 satellite-delivered superstations in existence.[93] WTBS, the most popular of the superstations, is available to 42 million cable households.[94]

The cable industry was further deregulated with the passage of the Cable Communications Policy Act of 1984. Under the new law, and subsequent Commission rules implementing it, most cable systems were freed of rate regulation of basic services beginning January 1, 1987. Among its other provisions, the new cable law provides cable operators with a reasonable expectancy that their franchises will be renewed and prevents the cities from establishing franchise fees which exceed five percent of the cable system's gross revenues from basic service. Cable systems responded to the new law by adjusting basic rates upward, to market-determined levels. According to a recent report, cable systems have increased basic service rates an average of 24 percent since January, 1987.[95] Some cable operators have, however, taken steps to offset this rise in basic service rates by offering more channels on the basic package.[96] Moreover, some cable operators have chosen to lower premium cable rates as they raise basic rates.[97] In these instances, cable subscribers who subscribe to a premium service may witness a decline in the total cost of purchasing both basic and premium cable services.

Pole Attachments

In order to provide cable service, a company must run wires, generally coaxial cable, from the system's headend to the subscriber. There are two basic ways in which to do this: (1) the wire can be placed underground, or (2) the wire can be strung from utility poles. Burying the wire is often physically impossible and always very expensive. Attaching the wire to existing utility poles, however, is much more economical, especially for cable systems covering large geographic areas, and often is the only viable means for running the wires.

Most utility poles are owned by electric or telephone companies. Of the poles that are owned by power companies, the telephone companies generally own the rights to the portion of the pole reserved for communications purposes (telegraph, telephone, cable television, etc.). Thus the telephone companies virtually control the availability of pole attachments for cable systems. The cable industry has long complained that the telephone companies have used their local monopoly on poles to obtain unfair and unreasonable terms, rates and conditions for pole attachments.[98]

In 1970 the National Cable Television Association (NCTA) petitioned the FCC to assert jurisdiction over pole attachments.[99] The FCC, however, was reluctant to claim jurisdiction, and directed the telephone and cable industries to reach a settlement.[100] With the FCC serving as mediator, NCTA and AT&T reached an interim agreement in 1975. The other telephone companies (e.g., GTE, United Telecommunications) did not honor the agreement, however.[101]

With the failure of the parties to reach a workable agreement, NCTA again asked the FCC to assert jurisdiction over pole attachments. In 1976, almost ten years after the FCC began its inquiry into the pole attachment issue, the FCC ruled that it did not have authority under the Communications Act to regulate pole attachments on non-telephone utility poles.[102] The FCC did, however, direct its staff to investigate the possibility of regulating pole attachments on telephone utility poles. The next year, however, the FCC concluded that it did not have the authority to regulate those arrangements either.[103]

Having lost the battle at the administrative level, the cable industry went to Congress. In 1978, Congress amended the Communications Act to give the FCC authority over pole attachments.[104] Under Section 224 the FCC can set rates, terms, and conditions for pole attachments, unless the state government in question has imposed its own regulations. The FCC rates are required to be "just and reasonable," which the Act defines as "assuring a utility the recovery of not less than the additional costs of providing pole attachments, nor more than an amount determined by multiplying the percentage of the total duct or conduit capacity, which is occupied by the pole attachment by the sum of the operating expenses and actual capital costs of the utility attributable to the entire pole, conduit, or right-of-way."[105]

By 1984, almost half of the states had adopted some form of pole attachment regulations. Many of them, however, never implemented them. This left a regulatory vacuum, as the FCC could not regulate after a state adopted pole attachment regulations. To correct this problem, Congress amended Section 224 to allow FCC regulation until a state actually implemented its own regulations.[106]

The FCC's regulation of pole attachments, particularly the establishment of rates, has been challenged several times. In the summer of 1987 the Supreme Court upheld the FCC's power, however.[107] In a case before the courts, Florida Power challenged an FCC rate determination. Upon review, a Circuit Court of Appeals found section 224 to be an unconstitutional taking and thus in violation of the Fifth Amendment.[108] The Supreme Court reversed, finding that Section 224 allowed for a "reasonable" payment to the utility company for the use of its poles.[109] Since the Court did not find the FCC's actions to be an unreasonable taking under the Fifth Amendment, it upheld the FCC's power to regulate pole attachment rates.

Major Issues

Copyright Issues

When cable television came onto the scene in the late 1940s, it was seen as a way to increase the audience of local broadcast stations and not as a threat to broadcasters or copyright owners. With the development of distant signal importation, in the mid-to-late Fifties, however, cable was perceived as a threat. Copyright owners feared that this importation of signals would diminish the value of their programming.

The copyright owners went to court to collect royalties from the cable operators for the retransmission of their programs. The Supreme Court, however, in Fortnightly Corp. v. United Artists Television, Inc.,[110] determined that cable did not have any copyright liability under the 1909 Copyright Act. This conclusion was based on the Court's finding that secondary transmissions were not a "performance," and thus did not constitute a copyright infringement. While this decision only dealt with retransmissions of "local" signals, six years later the Court extended this rationale to include retransmissions of distant signals.[111]

Having failed to establish copyright liability for cable television under the then existing law, the copyright owners sought to have Congress include such a provision in the redraft of the Copyright Act then in progress. As the prevailing view was that secondary transmissions were a copyright infringement under the 1909 Act, Congress was amenable. Congress was concerned, however, that "it would be impractical and unduly burdensome to require every cable system to negotiate with every copyright owner whose work was retransmitted by a cable system."[112] It thus created a compulsory license for cable television, rather than imposing full copyright liability.

The compulsory license is conditioned on royalty payments established in section 111(d) of the Copyright Act of 1976.[113] For each six month accounting period, cable operators must provide the Copyright Office information including: the name and location of each broadcast station whose signals were carried by the cable system; and the system's gross subscriber receipts from the secondary retransmission of both local and distant broadcast signals.[114]

Although the initial royalty rates were set in the Copyright Act, the Copyright Royalty Tribunal (CRT) is empowered to adjust them in certain circumstances. The CRT can adjust the rate schedules for inflation and in response to changes in the FCC rules governing cable.[115] It did the latter in 1982 when it (1) created a new surcharge to compensate copyright owners for repeal of the syndicated exclusivity rules; and (2) adjusted the rate for each "distant signal equivalent" (DSE) added to the cable system after June 24, 1981, to 3.75% of gross revenues from basic service. The Act also instructs the CRT to review the rates every five years.[116]

The semi-annual royalty payment which is imposed and collected is related to each cable system's size, the number of DSEs it has carried, and whether the signals of those stations were carried prior to the changes in the FCC's distant signal and syndicated exclusivity rules. Industry-wide, cable operators pay about one percent of their gross revenues to the Copyright Office for the automatic right to retransmit broadcast signals. Total annual payments are shown in Table 5.

TABLE 5
Annual Payments under the Cable Compulsory License[117]

Year	Amount Paid
1978	$ 12.9 million
1979	15.9 million
1980	20.1 million
1981	30.8 million
1982	40.9 million
1983	69.6 million
1984	86.8 million
1985	102.0 million
1986	121.0 million
1987	140.0 million

The Copyright Act also created the Copyright Royalty Tribunal to oversee the distribution of the monies collected under the compulsory license, as well as to adjust the rates of the license.[118] The Act permits copyright holders to agree on apportionment of the royalties, but provides the CRT the power to distribute the monies if the parties cannot agree. In that event, the CRT considers all claims for the royalties and determines an equitable distribution through a two step process. First, the CRT divides the claims into categories of claimants, and then distributes the royalties to major trade associations representing each category. The largest claimant is the motion picture industry, with professional sports, public broadcasting, music, commercial broadcasting, Canadian broadcasters and religious concerns being the other categories (in descending order of share).[119] The second phase of the distribution proceeding involves the disbursing of the monies to the individual copyright owners within the categories.

Since its establishment many entities have called for a repeal of the compulsory license. As early as 1979, only a year after the compulsory license went into effect, the administration was calling for its repeal. These requests, particularly those from the broadcast industry, intensified with the FCC's repeal of the syndicated exclusivity and distant signal rules, and with the demise of the must carry rules.[120]

The compulsory license itself has been criticized, primarily on the basis that it deprives copyright owners of the right to negotiate for compensation for their own work. NTIA has supported its repeal and in the interim its continuation only in return for an obligation to carry all local signals. The CRT has also been criticized by broadcasters, the cable industry, copyright owners, the courts, the Congress, and the General Services Administration. The majority of these criticisms stem from the limited staff size of the CRT, the inexperience of the Commissioners in copyright matters, and the lack of statutory guidance. Several of the suggested changes concern the method of distributing the monies collected under the compulsory license.

Concentration of Cable Ownership

Ownership concentration in the cable television industry has increased over the last six years. As Table 6 shows, the four largest Multiple System Operators (MSOs) account for 38 percent of all cable subscribers, up from 28 percent in 1983.

TABLE 6[illegible]
Percentage of Total Subscribers
Controlled by the Four, Eight, and Twenty
Largest Cable Companies

Year	Top Four Companies	Top Eight Companies	Top Twenty Companies
1987	38%	50%	70%
1986	26%	38%	60%
1985	29%	42%	64%
1984	28%	42%	64%
1983	28%	42%	61%

The increase in cable concentration may simply be a reflection of the possible efficiencies associated with increasing firm size. However, some parties, notably the Motion Picture Association of America ("MPAA") and Satcom, believe that the trend toward greater cable concentration go beyond firms' attempts to become more efficient and, as a result, have asked the Commission to adopt a rule limiting multiple ownership of cable systems.

The structure of the cable industry affects the terms and conditions of transactions that take place in the programming supply market. High levels of cable concentration increase MSO bargaining power with program suppliers when negotiating for the exhibition rights for programs. One of the key issues in the debate over cable ownership is the identification of the level at which cable concentration poses an anticompetitive threat to program suppliers. It is possible, for instance, that up to a certain level of concentration in the cable industry there is no harm since it may enable cable operators to negotiate with an equally, if not more, concentrated industry -- the program supply industry. Moreover, as the Commission notes in its study of cable ownership, the acquisition of multiple cable systems by a single firm can lead to the establishment of a fourth network and, therefore, may have strong procompetitive effects.[122] These and other considerations require that rules on multiple systems ownership be adopted only after careful deliberation. NTIA has called upon the FCC to initiate an inquiry on the effects of concentration on diversity.

Ownership of Programming Networks by Cable Systems

In the past 10 years, cable operators have succeeded in either purchasing or developing their own source of program supply. For instance, the three major premium cable networks are all affiliated with a large MSO. Table seven documents that owners of cable television systems currently hold consideable equity interests in large number of cable program services:

Table 7[123]
Interest of Cable Television System Owners
in Other Cable Program Services

TELE-COMMUNICATIONS INC. (TCI)

American Movie Classics (50%)
Black Entertainment Television (16.5%)
Event-TeleVision [Pay-Per-View] (10%)
Cable Value Network (11.3%)
Discovery Channel (10%)
The Preview Channel (unspecified)
The Fashion Channel (unspecified)
Pirates on Cable and other local sports services
Turner Broadcasting [WTBS, CNN, Headline News] (with 18 other MSO's & private investors, owns 35%)

VIACOM INTERNATIONAL/Viacom Cable

Showtime (100%)
The Movie Channel (100%)
Viewers Choice I & II [Pay-Per-View] (100%)
MTV (100%)
VH-1 (100%)
Nickelodeon (100%)
Nick-at-Nite (100%)
Lifetime (33%)
Cable Value Network (2.4%)

TIME, INC./ATC Cable Systems (owns 82%)

HBO (100%)
Cinemax (100%)
Festival (100%)
Black Entertainment Television (16.5%)
Cable Value Network (8.7%)
The PreView Channel (unspecified)
The Fashion Channel (unspecified)

TAFT BROADCASTING/TCI Taft Cablevision (owns 50%)

Black Entertainment Television (16.5%)

HEARST CORPORATION/Hearst Cablevision of CA

Lifetime (33%)
Arts & Entertainment Network (33%)

TABLE 7 (Continued)

STORER COMMUNICATIONS/Storer Cable Communications

- New England Sports Network (part interest)

COX ENTERPRISES/Cox Cable Communications

- Discovery Channel (10%)
- The Playboy Channel (unspecified)
- Bravo (unspecified)
- San Diego Cable Sports Network (100%)

CABLEVISION SYSTEMS

- Rainbow Programming Enterprises (100%)
    - American Movie Classics (50%)
    - Bravo (100%)
    - PRISM (100%)
    - Sports Channel (New England) (100%)
    - Sports Channel (New York) (100%)
    - Sports Channel (Chicago) (100%)
    - Sports Channel (Florida) (100%)
- Cable Value Network (2.9%)
- The Fashion Channel (unspecified)

UNITED CABLE TV CORPORATION

- Discovery Channel (10%)
- Cable Value Network (2.6%)
- The Preview Channel (unspecified)
- The Fashion Channel (unspecified)
- KSPN (Rocky Mountain regional "superchannel")

TIMES MIRROR CABLE TV

- Arizona Sports Programming (100%)
- Cable Value Network (2.2%)
- The Preview Channel (unspecified)
- The Fashion Channel (unspecified)

NEWHOUSE

- The Discovery Channel (10%)

JONES INTERCABLE

- Sky Merchant (100%)

TEMPO ENTERPRISES, INC.

- Tempo Television (100%)

LANDMARK COMMUNICATIONS

- The Weather Channel (100%)

Vertical integration by cable systems into programming may expand the supply of that programming. By bearing some of the financial risks in starting a new program service, for example, a cable operator can increase the possibility that the service will make it to the marketplace.[124] Nevertheless, some have expressed concern about the growing equity participation by cable systems in programming because it creates the possibility that cable operators will, in making program carriage decisions, discriminate in favor of those programs in which they hold an equity interest and against programs in which they do not.

There are, of course, limits to a cable operator's ability profitably to discriminate against a non-affiliated cable programming service. To be sure, some programming services are so popular that an operator's affiliation or non-affiliation with those services will have no bearing on his decision whether or not to carry them. A recently completed study has shown, for instance, that ATC systems are just as likely to carry Showtime, an unaffiliated, competing pay service as non-ATC systems.[125] This study also shows that ATC systems carry their affiliated pay service Home Box Office ("HBO") with the same frequency as systems with no ownership interest in HBO.[126] The study obtained similar results with respect to the carriage of basic cable networks.[127] One can tentatively conclude, therefore, that the tendency ownership of programming services by cable systems will likely not lead to discrimination in the carriage of programming services.

Vertical integration may also enable cable operators to preclude or impede competitive entry into their franchise areas by users of alternative distribution technologies. Cable operators could attempt to defeat or delay competitive entry by vertically integrating into the program supply market and denying these competitors access to their most abundant source of programming -- existing cable networks.[128]

Restricted Entry Versus Competitive Open Entry

In most cases, before a cable operator can provide cable service it must receive permission to do so from the local municipal authority. This permission is commonly in the form of an franchise agreement wherein the cable operator is granted the right to wire, often on an exclusive basis, a predetermined number of households in exchange for the promise to satisfy various franchise requirements.[129] Today, the local government's franchising authority over cable television is under attack.[130] Opponents of the franchising practice argue that governments should not erect monopolistic barriers in the form of municipal franchises, especially since Congress has eliminated rate regulation for the vast majority of cable systems. Proponents of the franchising system argue that the system serves the public interest since cable service is better provided by a single cable service provider.

The act of granting an exclusive franchise (whether explicit or *de facto*) to a cable operator raises the questions of whether the policy of awarding an exclusive franchise really serves the public interest. The answer depends, in part, on; (1) whether the practice of extracting concessions from the incumbent cable operator is desirable and (2) whether a single firm can provide higher quality, more diverse and lower cost cable service than two or more firms.

On the issue of extracting concessions, the services that the regulatory authorities are able to implicitly demand, in the guise of the bidding process, are those for which the cost appears to exceed the value placed upon them by viewers. This follows from the notion that a cable operator, free from any requirements placed upon him by a franchise authority, would carry only those programs for which the benefit to the viewer exceeds the cost of supply. Therefore, the current franchising process will impose numerous costs on the television viewer. A study of the cost of franchise requirements estimates that basic service rates are nearly 30 percent higher and service subscriptions nearly 12 percent lower than they would be in the absence of such requirements.[131]

Finally, opponents of the franchising process have argued that the current system has placed the franchising authorities in the unenviable position of choosing among many cable proposals. As a result, the current system (1) delays construction; 2) lends itself to "gamesmanship" in that applicants have an incentive to understate prices and overstate the services they will provide; (3) creates economic waste in the form of expensive campaigns to "win" the franchise; and (4) invites political corruption. Morever, where circumstances would permit one or more viable competitors to enter the market, subscribers are deprived of potentially more quality, choice, innovation, and lower prices. All of the above criticisms call into question the policy wisdom of granting an exclusive franchise to cable operators.

High Definition Television ("HDTV")

HDTV is a generic term referring to a new generation of television receivers and production equipment. HDTV will provide superior picture clarity and a larger aspect (width-to-height) ratio compared to current receivers. HDTV technology could revolutionize television, and become a $25 to $50 billion market in the next decade.[132] In addition, if some media (e.g., cable) can provide this new technology significantly before other media (e.g., broadcast television), there could be a fundamental change in the competitive environment of the video marketplace.

The current television technology, known as NTSC, was developed by the National Television System Committee in 1940, when television was in its infancy. The NTSC system, originally developed for monochrome (black-and-white) transmissions and subsequently enhanced to include color and stereo sound, uses 525 lines per frame and has an 4:3 aspect ratio. HDTV transmissions will have more than twice as much information per frame, over 1100 lines, and approximately a 5:3 aspect ratio. The resulting difference is that while NTSC transmissions are like a 16mm film, HDTV creates a picture similar in clarity, brightness and color to a 35mm motion picture shown in theatres.[133]

The major issue for cable concerning the introduction of HDTV is the establishment of a transmission system that is compatible with the current NTSC system. This compatibility question focuses on two aspects of an HDTV transmission: (1) the bandwidth requirement for HDTV transmissions, and (2) the ability of NTSC receivers to receive a viewable signal from an HDTV transmission.

The current allocation for television in the U.S. is based upon 6 Mhz channels, the NTSC transmission standard. Cable channels, like broadcast television channels, are based upon this 6 MHz bandwidth. HDTV transmissions, with their increased picture clarity, may not be able to contain all of their information in that bandwidth, however. For instance, the NHK MUSE system, currently the most tested HDTV transmission system, requires 8.1 MHz bandwidth.[134] On the other hand, the ACTV system, developed by NBC, needs only 6 MHz, and thus can be used within the existing channel bandwidth.[135] Other systems are being developed by North American Phillips Corporation, The Del Ray Group, the New York Institute of Technology, Bell Laboratories, General Electric and CBS, Inc. A European system is scheduled for late 1988 or early 1989.[136]

If HDTV requires a larger bandwidth channel than currently alloted to television, the FCC may have to reallocate the television allocation. The controversy and resultant delays in such a major undertaking will likely forestall the provision of HDTV by broadcasters.[137] This could allow the other video services, including cable, to gain a technological advantage, which would alter the competitive environment of the video marketplace.[138] For example, the Japanese plan to begin transmitting HDTV from a direct broadcasting satellite in 1990,[139] and HDTV could be available in the United States through videocassette recorders by 1991.[140] HBO plans to begin distributing HDTV programming to certain cable systems by 1991.[141]

While cable does not face the spectrum allocation problems encountered by broadcast television, the potential need for additional bandwidth for HDTV transmissions could hinder provision of HDTV by cable. As noted, cable channels are based on 6 MHz bandwidth. Cable systems can, however, handle larger bandwidth transmissions by combining channels.[142] Such a restructuring of a cable system's channels may require the system to drop some existing services. This could be a major problem for cable systems with small channel capacity and other systems which do not have many vacant channels. Another solution would be to upgrade the systems, but that can be very expensive.[143]

Another important concern of cable, and all of the various transmission systems, is the compatibility of HDTV transmissions with NTSC receivers.[144] There are currently over 130 million NTSC television receivers in the U.S., valued at over $80 billion.[145] The total investment in existing NTSC system equipment is over $100 billion.[146] If HDTV transmissions are not viewable on NTSC receivers, this equipment may be rendered obsolete. One the other hand, the lack of compatibility, coupled with the high initial costs of HDTV receivers, estimated to be up to $4,000 each,[147] may retard if not prevent the adoption of HDTV by both the broadcast community (including cable television) and consumers. If, however, the problem of incompatibility may be overcome by the development of an adapter so that NTSC receivers could display a viewable picture from an HDTV transmission, then it is more likely that HDTV will be quickly adopted by both consumers and the broadcast community. [148]

Major Trends

Like all industries, the cable television industry has evolved through time in response to changing market conditions. Perhaps the most dramatic change has been the elimination of many regulations that, for many years, regulated the growth of the cable television industry. Another important change has been the improvement in technology, particularly the ability to transmit video images via satellite.

One of the oldest issues affecting the industry involves the question of the appropriate level of copyright fees. Copyright owners have been arguing that the existing mechanism governing copyright payments is fair neither to them nor to society in general. The cable industry has responded by entering into negotiations with one of the major representatives of the copyright owners. However, these negotiations have not resolved the differences that exist. As a result, it appears that there may not be any change in copyright fees in the near future. But the arguments remain and the issue of the level of copyright rates must one day be resolved.

There are, other developments that could affect the industry in very near future and certainly within the next five years. One such development is heightened concern about growing levels of ownership concentration and vertical integration within the industry. This concern could eventually trigger governmental action that could substantially influence the structure of the industry. As discussed more fully in the NTIA Video Study, we do not believe that vertical integration within the cable industry raises competitive concerns sufficient to warrant governmental action at this time.[illegible] On the other hand, we have concluded that ownership concentration within the industry has reached levels that warrant investigation and, perhaps, action by the FCC.[illegible]

Potentially the most beneficial development for cable customers is the issue of competitive entry and competition. With regard to the former, recent court decisions have begun to dismantle the protective armor around cable's exclusive franchise and, as a result, there may be more overbuilds within cable communities. Moreover, the FCC is currently considering the desirability of allowing telephone companies to provide video service to the home.[illegible] If allowed, the impact on the cable industry may be dramatic. First, telephone companies may participate in the construction of "overbuilds" and, in so doing, extend the benefits of competition to cable subscribers. Second, because of technical/economic problems associated with reconfiguring their networks, telephone companies could be aggressive buyers of existing cable systems. Third, overbuilds may have the effect of improving the price/quality relationship for the subscribers.

Within the next five years the cable industry may experience more vigorous competition from Direct Broadcast Satellites ("DBS"). Until now, the major obstacle facing DBS has been the high cost of the parabolic receiving dish. Recently, however, technological change has led to the development of an inexpensive flat dish (antenna) capable of receiving satellite video transmissions. Besides being aesthetically more appealing than its parabolic counterpart, these flat dishes are smaller, lighter, and less expensive to install than traditional dishes. As a result, these new dishes will likely become a strong competitive threat to the local cable operator.

In summary, the cable industry has evolved from a sector that did little more than serve as a good antenna in areas where broadcast television service was poor to an industry in which service offerings commonly include interactive services, distant broadcast signals and premium channels, in addition to the local broadcast channels. Along the way, it has become a mature, profitable industry. However, significant challenges loom on the horizon. The ability of the industry to meet some of these challenges will determine whether the industry will be able to maintain its current levels of financial success.

Notes

1. Broadcasting, Sept. 12, 1988, at 18. Broadcasting's data indicate that 73.9 million of the nation's 88.6 million television households (or 83.4 percent) are passed by cable television. Precise subscribership data is difficult to obtain, however. Broadcasting magazine counted slightly more than 47 million cable subscribers as of September 1988. Broadcasting, Sept. 12, 1988, at 18. Paul Kagan Associates, a noted media analyst, identified 44.6 million subscribers as of July 29, 1988. Paul Kagan Assoc., Inc., The Kagan Media Index, Aug. 19, 1988, at 3. Finally, A.C. Nielsen counted slightly fewer than 45 million subscribers in November 1987. Cabletelevision Advertising Bureau, Inc., Cable TV Facts '88, at 4 (citing data from A.C. Nielsen).

2. Available data suggest that about 36 percent of the homes with access choose not to subscribe. See id.

3. Electronic Media, Apr. 6, 1987, at 39, quoting Ralph Baruch, Chairman, Viacom International.

4. For a detailed review of the cable industry and the issues currently facing the industry, see NTIA, Video Program Distribution and Cable Television: Current Policy Issues and Recommendations, NTIA Report 88-233 (July 1988) ("NTIA Video Study").

5. For a more complete discussion of cable system technology and architecture, see id., App. B, at 3-10.

6. See note 1, supra.

7. Subscribership figures are for number of homes subscribing to "basic cable service." Basic service commonly refers to a package of services, including retransmitted broadcast signals and cable exclusive programming, made available for a designated monthly fee. In some cases, an additional complement of these types of signals is marketed as so-called "extended basic service" for an additional monthly fee. Premium, or pay, service denoted programming that is sold on a per-channel or per-program basis. Typically, a customer must purchase basic service in order to get extended basic service, if available, or pay service. A.C. Nielsen estimated that, in February 1988, about 28.3 percent of all U.S. households (roughly 56 percent of all cable households) subscribed to at least one pay service. See Communications Daily, Apr. 27, 1988, at 6.

8. Sources: number of systems, 1988 Television & Cable Factbook (Cable & Services Volume) at C-358; subscribers and penetration, Cabletelevision Advertising Bureau, Inc., Cable TV Facts '88, at 4 (based upon data from A.C. Nielsen). Data on subscribers and penetration are as of November of each year; system data for each year are as of January 1 of the following year.

(e.g., the figure given for 1987 reflects the number of systems as of January 1, 1988).

9. NTIA Video Study at 10.

10. 1988 Television & Cable Factbook (Cable & Services Volume) at C-359 (data as of April 1, 1988).

11. Sources: 1988, 1988 Television & Cable Factbook (Cable & Services Volume) at C-359 (data as of April 1, 1988); 1982-83 Television & Cable Factbook (Cable & Services Volume) at 1548 (data as of March 1, 1983).

12. Sources: 1988, 1988 Television & Cable Factbook (Cable & Services Volume) at C-359 (data as of April 1, 1988); 1982-83 Television & Cable Factbook (Cable & Services Volume) at 1548 (data as of March 1, 1983).

13. Source: Paul Kagan Assoc., Inc., The Kagan Cable TV Financial Databook at 12-13, 70 (June 1987). Basic service revenues include monies from expanded basic offerings. See note 7, supra. Total revenues do not include miscellaneous monies from, for example, remote control units, second set hook-ups, and home shopping.

14. Pub. L. No. 98-549, 98 Stat. 2779 (codified at 47 U.S.C. Sec. 521-559 (Supp. III 1985)).

15. See Implementation of the Provisions of the Cable Communications Policy Act of 1984, 50 Fed. Reg. 18637, 1648-50 (1985), aff'd in part and rev'd in part sub nom. American Civil Liberties Union v. FCC, 823 F.2d 1554 (D.C. Cir. 1987), cert. denied, 108 S.Ct. 1220 (1988), modified on remand, Second Report and Order in MM Docket No. 84-1296, FCC 88-128 (released Apr. 12, 1988).

16. See Electronic Media, Mar. 28, 1988, at 35.

17. Paul Kagan Associates, Inc., Cable TV Investor, Data Roundup, July 24, 1987, pg. 4.

18. After increasing by about 29 percent between 1978 and 1985, the average pay service declined for the first time between 1985 and 1986. Continued rate reductions are projected well into the 1990s. See Paul Kagan Assoc., Inc., The Kagan Media Index, July 26, 1988, at 2. Pay networks' ability to counteract the softness in subscription will, however, depend upon the basic rate increases put into affect by the cable operator. Since basic cable service must first be subscribed to before the household can subscribe to a pay network, a drop in pay price may be completely or partially offset by a rise in the rate for basic service.

19. Source: Paul Kagan Assoc., Inc., The Kagan Media Index, Aug. 19, 1988, at 8.

20. Id.

21. The cable industry instituted pay-per-view in response to, among other things, the erosion of pay service revenues caused by the spread of videocassettes. It follows, therefore, that a program will generally be offered on a pay-per-view basis before its release on videocassette.

22. Source: Paul Kagan Assoc., Inc., The Kagan Media Index, Aug. 19, 1988, at 8.

23. Paul Kagan Associates, Inc., Pay TV Newsletter June 26, 1987, p.2.

24. Although not the norm, prices paid for cable systems have reached as high as $2,500 to $3,000 per subscriber. See Media Business News, Dec. 7, 1987, at 2.

25. Communications Daily, July 26, 1988, at 7.

26. Wall St. J., Oct. 19, 1987, at 4.

27. Provided either as part of the basic package or for an additional subscriber fee, these regional sports networks have a combined viewer base of nearly 9 million subscribers.

28. Electronic Media, April 6, 1987, at 39, quoting Ralph Baruch, Chairman, Viacom International. By contrast, the three major broadcast networks (ABC, NBC, CBS) combined pay about $3 billion for prime-time programming.

29. 47 U.S.C. 201 et seq. (1982).

30. Frontier Broadcasting Co. v. Collier, 24 FCC 251 (1958).

31. Id. at 255-56.

32. See CATV and TV Repeater Services, 26 FCC 403, 404-5 (1959).

33. Id. at 427-29.

34. Id. at 429-430.

35. Id. at 430-31.

36. An unsuccessful attempt was made in 1959 to extend section 325 to cover cable retransmissions.

37. Intermountain Broadcasting & Television Corp. v. Idaho Microwave Inc., 196 F.Supp. 315 (S.D. Idaho 1961).

38. Cable Vision v. KUTU, 211 F.Supp. 47 (S.D. Idaho 1962), rev'd, 335 F.2d 348 (9th Cir. 1964).

39. Cable Vision v. KUTU, 335 F.2d 348 (9th Cir. 1964). See discussion of cable copyright issues, infra.

40. Carter Mountain Transmission Corp., 32 FCC 459 (1962), aff'd, 321 F.2d 359 (D.C. Cir.), cert. denied 375 U.S. 951 (1963).

41. Notice of Proposed Rule Making in Docket No. 14895, 27 Fed. Reg. 12586 (1962).

42. First Report and Order in Docket Nos. 14895 and 15233, 38 FCC 683 (1965).

43. See Notice of Inquiry and Notice of Proposed Rulemaking in Docket No. 15971, 1 FCC 2d 453 (1965).

44. Second Report and Order in Docket Nos. 14895, 15233 and 15971, 2 FCC 2d 725 (1966).

45. In order for a cable system to retransmit a television signal beyond its Grade B contour and into one of the top 100 markets there had to be a showing that such importation would be in the public interest, in other words, that it would not harm local UHF stations. Id. at 781-84

46. Id. at 728-34.

47. Another unsuccessful attempt to amend the Communications Act to specifically include cable television was made in 1966 in reaction to an FCC request contained in its Second Report and Order on cable. See 2 FCC 2d at 787-88.

48. 392 U.S. 157 (1968).

49. Notice of Proposed Rulemaking and Notice of Inquiry in Docket No. 18397, 15 FCC 2d 417, 437-49 (1968).

50. First Report and Order in Docket No. 18397, 20 FCC 2d 201 (1969). The Supreme Court narrowly upheld these rules as being within the FCC's ancillary jurisdiction. United States v. Midwest Video Corp., 406 U.S. 649 (1972).

51. Second Report and Order in Docket No. 18397, 23 FCC 2d 816 (1970).

52. Section 214 Certifications, 21 FCC 2d 307 (1970).

53. Cable Television Proposals, 31 FCC 2d 115 (1971).

54. The text of the Consensus Agreement can be found at 36 FCC 2d 284-86.

55. Cable Television Report and Order, 36 FCC 2d 143 (1972).

56. See note 45 supra.

57. First Report and Order in Docket Nos. 19544 and 18893, 52 FCC 2d 1 (1975).

58. Home Box Office, Inc. v. FCC, 567 F.2d 9 (D.C. Cir.), cert. denied 434 U.S. 829 (1977).

59. Report and Order in Docket No. 21002, 66 FCC 2d 380 (1977).

60. Notice of Inquiry in Docket No. 21284, 65 FCC 2d 9 (1977).

61. Economic Relationship Between TV Broadcasting and CATV, 71 FCC 2d 632 (1979).

62. CATV Syndicated Program Exclusivity Rules, 79 FCC 663 (1980) aff'd sub nom. Malrite TV of New York v. FCC, 652 F.2d 1140 (2d Cir. 1981), cert denied sub nom. National Football League v. FCC, 454 U.S. 1143 (1982).

63. FCC v.Midwest Video Corp., 440 U.S. 689 (1979).

64. Pub. L. No. 98-549, 98 Stat. 2779 codified at 47 U.S.C. 521-559 (Supp. III 1985). See H. Rep. No. 934, 98th Cong., 2d Sess., reprinted in 1984 U.S. Code Cong. & Admin. News 4655.

65. 47 U.S.C. 541 et seq (Supp. III 1985). See H. Rep. No. 934 at 19.

66. 47 U.S.C. 531, 532 (Supp. III 1985).

67. Id. 542.

68. Id. 543. The FCC defined "effective competition" as the availability of any three over-the-air broadcast signals in the cable community. Signals were considered available if they placed a Grade B contour over any part of the cable community. Implementation of the Provisions of the Cable Communications Policy Act of 1984, 50 Fed. Reg. 18637, 1648-50 (1985),

aff'd in part and rev'd in part sub nom. *American Civil Liberties Union v. FCC*, 823 F.2d 1554 (D.C. Cir. 1987), *cert. denied*, 108 S.Ct. 1220 (1988).

69. 47 U.S.C. 533 (Supp. III 1985).

70. *Id*. 554.

71. *Quincy Cable TV, Inc v. FCC*, 768 F.2d 1434 (D.C. Cir. 1985), *cert. denied*, 106 S.Ct 2889 (1986).

72. The new must carry rules limited the number of channels a cable system had to devote to must carry to 25 percent of the cable system's channel capacity, with cable systems of under 20 channels entirely exempted from the rule. The cable operator was able to choose which local stations to place on its system from a pool of qualified stations, based on a viewing standard. In addition, systems were required to carry the unduplicated signal of the local non-commercial station. *Must Carry Rules*, 61 RR 2d 792 (1986), *modified* 62 RR 2d 1251 (1987).

73. *Century Communications Corp. v. FCC*, 835 F.2d 292 (D.C. Cir. 1987), *clarified*, 837 F.2d 517 (D.C. Cir.), *cert. denied*, 56 U.S.L.W. 3816 (May 31, 1988).

74. 106 S.Ct 2034 (1986).

75. 47 C.F.R. 63.54-63.58, 76.501 (1986).

76. *Id*. 76.605.

77. *Id*. 76.616.

78. *Id*. 76.611.

79. *Id*. Part 78.

80. *Id*. 76.205.

81. *Id*. 76.213.

82. *Id*. 76.67.

83. *Id*. 76.92.

84. *Id*. 76.305, 76.403.

85. *Id*. 76.71 *et seq*.

86. See, e.g., CATV Syndicated Program Exclusivity Rules, 79 FCC 663 (1980), aff'd sub nom. Malrite TV of New York v FCC, 652 F.2d 1140 (2d Cir. 1981), cert denied, 454 U.S. 1143 (1982), Economic Relationship Between TV Broadcasting and CATV, 71 FCC 2d 632 (1979); Must Carry Rules, 61 RR 2d 792 (1986), modified 62 RR 2d 1251 (1987), rev'd sub nom. Century Communications Corp. v. FCC, 835 F.2d 292 (D.C. Cir. 1987), clarified, 837 F.2d 517 (D.C. Cir.), cert. denied, 56 U.S.L.W. 3816 (May 31, 1988).

87. See text associated with footnotes 35-39.

88. For a description of the rules governing pay television, see Rules and Regulations to Provide for Subscription Television Service, 15 FCC 2d 466 (1968). For a description of the carriage rules, see Cable Television Report and Order, 36 FCC 2d 143 (1972).

89. See Besen and Crandall, The Deregulation of Cable Television, 44 Law and Contemp. Prob. 77 (1981).

90. American Broadcasting, Inc., 62 FCC 2d 901 (1977).

91. National Cable Television Association, National Cable Network Directory (Aug. 1987).

92. Id.

93. Broadcasting, Nov. 30, 1987, at 47.

94. National Cable Television Association, National Cable Network Directory (Aug. 1987).

95. Paul Kagan Associates, Inc., Cable TV Franchising, May 29, 1987.

96. See Fairchild Publications, Multichannel News Research, Apr. 6, 1987, at 35, Nov. 3, 1986, at 35.

97. See Fairchild Publications, Multichannel News Research, Apr. 6, 1987, at 35; Nov. 3, 1986, at 35.

98. See S. Rep. No. 580, 95th Cong., 2d Sess., reprinted in 1978 U.S. Code Cong. & Admin. News 109, 120-22.

99. See Calif. Water & Telephone Co., 22 FCC 2d 10 (1970).

100. See Pole Attachment Proceedings, 38 R.R. 2d 957 (1973).

101. See Hamburg, All About Cable at 6-5 to 6-6 (1986).

102. California Water & Tel. Co., 37 RR 2d 1166 (1976).

103. California Water & Tel. Co., 64 FCC 2d 753 (1977).

104. Pub. L. No. 95-234, 92 Stat. 33, codified at 47 U.S.C. 224 (1982).

105. 47 U.S.C. 224 (d)(1) (1982).

106. Pub. L. No. 98-549 4, 98 Stat. 2801 codified at 47 U.S.C. 224(c)(3).

107. FCC v. Florida Power Corp., 107 S.Ct 1107 (1987).

108. 772 F.2d 1537 (11th Cir. 1985).

109. 107 S.Ct. at 1113.

110. 392 U.S. 390 (1968).

111. Teleprompter Corp. v. CBS, 415 U.S. 394 (1974).

112. H. Rep. No. 1476, 94th Cong., 2d Sess. 89, reprinted in 1976 U.S. Code Cong. & Ad. News 5659, 5704.

113. 17 U.S.C. 111(d).

114. Cablevision Co. v. Motion Picture Ass'n of America, 641 F.Supp 1154 (D.D.C. 1986).

115. 17 U.S.C. 801(b)(2).

116. 17 U.S.C. 804.

117. Source: Copyright Royalty Tribunal.

118. 17 U.S.C. 801(b)(3).

119. Source: Copyright Royalty Tribunal.

120. See NTIA, Cable Retransmission of Broadcast Television Programs Following the Elimination of the "Must Carry" Rules (1985).

121. Source: NTIA Video Study, Attachment 2, at 1-6.

122. FCC Policy on Cable Ownership, Staff Report, Office of Plans and Policy, 1981.

123. Source: Comments of the Motion Picture Association of America, Inc. in FCC Docket No. 87-24 at App. A (filed July 22, 1987).

124. For a further discussion of this point and other benefits of vertical integration in the cable context, see NTIA Video Study at 90-92.

125. Id. at 95-96.

126. Id.

127. Id. at 97-102.

128. See id. at 102-106.

129. Franchise requirements often include such items as large channel capacity, construction of an institutional network, a franchise fee, the construction of studios for local origination and the development of a community endowment.

130. The franchising process has been attacked on both first amendment and antitrust grounds. See Community Communications Co. v. City of Boulder, 455 U.S. 40 (1982); Preferred Communications, Inc. v. City of Los Angeles, 754 F.2d 1396 (9th Cir. 1985). See NTIA Video Study at 18 et seq.

131. Shew, William, "Costs of Cable Television Franchise Requirements," National Economic Research Associates, Inc. 1984.

132. Rowen, High-Density TV, Wash. Post, Sept. 24, 1987, at A25. For a fuller discussion of the market potential of HDTV, see L. Darby, Economic Potential of Advanced Television Products (Apr. 1988).

133. N.Y. Times, Sept. 18, 1987, at 35.

134. NHK, Broadcasting Systems for HDTV, at 8 (undated).

135. Broadcasting, Oct. 5, 1987, at 35.

136. Communications Daily, Sept. 1, 1987, at 1.

137. If additional bandwidth is needed for HDTV, it may come from the UHF band. Other services, i.e., land mobile radio, have sought allocations in this band, however.

138. FCC, "Inquiry Begun on Development and Use of Advanced TV Systems; Immediate Freeze on TV Allotments Imposed," Public Notice (July 16, 1987).

139. Wall St. J., Oct. 25, 1985, at 27.

140. Broadcasting, Oct. 26, 1987, at 64.

141. Id. at 66.

142. The cable industry has tested transmission of the NHK MUSE system, which uses 8.1 MHz. Communications Daily, Oct. 22, 1987, at 9.

143. Broadcasting, Oct. 26, 1987, at 74.

144. Id. at 66.

145. Broadcasting, Oct. 26, 1987, at 70.

146. N.Y. Times, Sept. 18, 1987, at 35.

147. Wall St. J., Aug. 24, 1987, at 25.

148. On September 1, 1988, the FCC issued several preliminary findings and conclusions regarding advanced television systems ("ATV"), including HDTV. "FCC Announces Fundamental Policies and Defines Boundaries for Development of Advanced Television," Rept. No. DC-1235, Mimeo 4389 (released Sept. 1, 1988). First, it determined that the benefits of ATV technology can be attained most quickly by allowing existing commercial television broadcasters to implement to implement HDTV and other advanced systems. It also concluded that initial ATV signals must be compatible with existing NTSC receivers or those signals must be provided on a separate channel. Finally, the FCC declined to allocate additional spectrum for ATV. In other words, if ATV technology requires more than the current 6 MHz channel, the additional spectrum would have to be found in the existing VHF and UHF frequency bands.

149. See NTIA Video Study, Chapter 6, at 89-107.

150. Id., Chapter 5, at 77-88, Attachment 2, at 7-12.

151. An FCC decision favoring provision of video service by local telephone companies in their service areas would appear to require legislation to amend the 1984 Cable Act, which appears to proscribe such activities. See 47 U.S.C. 533 (Supp. III 1985). In order for the Bell Operating Companies to provide certain video services, the information services restriction in the AT&T Consent Decree may have to modified or waived.

XIV

Public Broadcasting

by Helena Mitchell, Ph.D.

Many radio stations in the early 1920s were experimental. The majority were noncommercial stations licensed to educational institutions. In the early 1950s, educational institutions were among the first to explore television for educational purposes. Consequently, by 1967 when the term "public broadcasting" was coined, the world had come to know noncommercial broadcasting as the product of "educational" television and radio stations.

Contemporary noncommercial broadcasting includes "public," educational, and instructional services, with a range of facilities that differ greatly from those found in the infant days of the industry. The development of communications satellites has caused an evolution from broadcasting to national networking in public telecommunications. Today, educational communications are more likely to be a creature of telecommunications advances. New methods are being tested, and new technologies are evolving so that broadcasters, educators, and entrepreneurs can take advantage of the potential for technology to stretch beyond the traditional bounds of entertainment and education.

Those public and educational programming services use a variety of technologies to transmit their signals. Some of these are:[1]

1. Radio: Most commonly referred to as AM and FM over-the-air transmission of a broadcast signal. An audio system of communications. Amplitude Modulation (AM) uses the broadcast band at 550-1600 kilohertz, and in some private radio services such as citizens band (CB) and aviation. Frequency Modulation (FM) uses 88-108 megahertz on the broadcast band and is used in other bands for two-way communications in land mobile and marine services. FM is less susceptible to interference than AM broadcasting. According to FCC statistics, there are 1,339 FM educational stations.[2]

2. Television: Most commonly referred to as VHF and UHF over-the-air transmission of a broadcast signal. A visual system. Very High Frequency (VHF) is the part of channels 2-13, the FM broadcast band, and some marine, aviation, and land mobile services. Ultra High Frequency (UHF) is the part of the radio spectrum from 300 to 3000 megahertz which includes television channels 14-83, as well as many land mobile and satellite services. The FCC statistics indicate there are 334 (215 VHF and 119 UHF) educational television stations.[3]

3. Cable: The transmission of video programming and other services, including signals that originate at over-the-air television stations, to consumers on a wired network. Also known as Community Antenna Television (CATV), this is a service through which subscribers pay to have local television stations and additional programs brought into their homes via a coaxial cable. The National Cable Television Association statistics indicate there are 8,413 cable systems.[4] Even with the change in cable regulations, most systems carry a signal that originates at a public television station.

4. Instructional Television Fixed Service (ITFS): A fixed microwave station operated by an educational organization and used mainly to transmit instructional, cultural, and other educational information to fixed receiving stations. The Corporation for Public Broadcasting reported that in 1983, 34 public television stations held an ITFS license, operated an ITFS system, or both.

5. Satellite: A radio relay station that orbits the earth. A complete satellite communications system also includes earth stations which communicate with each other via the satellite. The satellite receives a signal transmitted by an originating earth station and retransmits that signal to the destination earth station(s). Satellites are used to transmit telephone, television, and data signals originated by common carriers, broadcasters, and distributors of CATV program material. Public television owns four transponders and public radio one transponder of the Westar IV satellite.

6. Fiber optics: A method for the transmission of information (sound, pictures, data). Light is modulated and transmitted over high purity hair-thin fibers of glass. The bandwidth capacity of fiber optic cable is much greater than that of conventional cable or copper wire. Some educational institutions are entering into joint partnerships with industry to take advantage of the technology. The numbers have not been calculated but such ventures appear to be steadily growing.

Early Educational Broadcasting

The use of various forms of electronic communications for noncommercial broadcasting and teaching has been part of the industry since the use of radio became a national habit. Noncommercial broadcasting can trace its origins to 1917 and the first radio signals broadcast from the University of Wisconsin's station 9XM.

In the 1920s, the Department of Commerce under then Secretary Herbert Hoover, held conferences regarding Federal government support of radio.[5] As a result of these conferences, it was decided that stations should be left to finance themselves, by the only method available -- sale of time to advertisers.[6] However, many of the early noncommercial radio stations were licensed to educational institutions and therefore did not become advertiser or commercially sponsored. In the early 1920s these stations numbered over 200.

By 1929, only 35 educational radio stations were actually on the air. Most of those which failed were unable to sustain the stations or meet the technical standards imposed by the Federal Radio Commission. As a result of reserved FM channels in the late 1930s and 1940s, approximately 50 educational institutions were able to establish radio facilities by 1945.

After World War II, another great educational experiment began with the use of television for teaching. People talked about being able to learn a foreign language at home through the television set. Schools purchased TV sets to use in classrooms and fledgling educational stations placed a teacher and blackboard in front of a single camera in a studio to lecture an entire city. Unfortunately, as soon as the novelty of television at school wore off, teachers discovered that the programming usually available was not as effective as their own teaching skills. The first time the television set did not work right or a program schedule was changed to a less convenient time of day, the set was moved to the closet to gather dust.

Legislative and Regulatory Interest

Legislative interest in educational broadcasting began as early as 1931 and grew partially out of efforts by educational broadcasters to convince the Federal government of the need to reserve stations for future use. On January 26, 1938, the Federal Communications Commission (FCC) adopted rules to govern noncommercial educational radio stations and allocated the first 25 channels for their exclusive use. AM was to be employed unless it could be shown that there was a need for FM. Later, in 1945, the FCC allocated twenty FM radio frequencies for noncommercial and educational users.

This FCC action, to set aside frequencies, was crucial to allowing the growth of educational broadcasting stations. FCC Commissioner Frieda Hennock was a strong supporter of educational use of the broadcasting spectrum in the early 1950s. In 1952, thanks to her efforts and those of others such as the Joint Council for Educational Television, the FCC reserved 242 channels (80 VHF and 162 UHF) for noncommercial television and passed rules to govern noncommercial educational stations.[7] By 1966, reserved television channels increased to 633.

Other early supporters appearing before the FCC and the Congress included the commercial networks who thought that educational broadcasting would both supplement their services and benefit viewers. In reality, commercial stations were also important to educational stations in those days through what was called a "close and beneficial" relationship.[8] It is estimated that between 1955 and 1967 about $15 million dollars came to educational stations from equipment donations of commercial stations and networks.[9]

The Ford Foundation and its subsidiary, the Fund for Adult Education, developed a matching scheme in 1952 to stimulate construction of educational stations. This enabled the first 30 educational television stations to go on the air.[10]

During the 85th Congress, Senator Warren Magnuson in May of 1957 introduced S. 2119, the first legislation to provide Federal government funding of noncommercial television broadcasting facilities. Between 1957 and 1960 other bills were introduced. It was not until 1961, however, in the 87th Congress, that S. 205 was to make it to conference and be passed by both Houses of Congress. President John F. Kennedy signed the Educational Television Act of 1962 to provide funding of facilities for educational television.

Focusing on the funding of educational facilities, the 1962 Act established the Educational Television Facilities Program in the Department of Health, Education and Welfare. The last grant awarded under the 1962 Act was in June 1967. A total of 161 grants to 153 television stations in 47 states, the District of Columbia, and Puerto Rico had been made. Of the 161, 92 stations had been activated and the only states without educational television stations were Alaska, Montana, and Wyoming. There were 184 television stations in the system compared to 82 before the program.[11]

Key Industry Statistics

In 1987, public broadcasting income amounted to $1.3 billion. Currently, there are 330 public TV stations and 310 radio stations qualified to receive grants from CPB.[12] Public television stations provide over 110 hours of programming each week, with local stations producing over 300 hours of their own programming per year.[13] The rest are syndicated, reruns or foreign acquisition. In a given week about 60 percent of the television homes view public television, yet overall rating or penetration is well under 10 percent of the audience.

Cultural, public affairs, informational and instructional programs are the basic fare of the system today. The sources of public television programs are many and diverse. They include major public television stations such as WNET in New York, WGBH in Boston and KCET in Los Angeles, as well as independent production houses as large as the Children's Television Workshop (creators of "Sesame Street"), and as small as the individual independent film maker producing a documentary or short series with funding from a grant from the National Endowment for the Arts. Programming is delivered either through PBS's four transponders or NPR's transponder 2D on the Westar IV satellite.

Noncommercial entities are looking at the promises of SCA channels, translators, subscription television, excess cable channel capacities, ITFS and satellite, as well as information services, digital telephone and computer systems.

Cable developments have also affected public television. In the early days of cable, systems had to carry all local stations, thus often giving public television stations, especially those on UHF- more viewer exposure. FCC "must-carry" rules adopted in the spring of 1987 relieved these systems by requiring that they only carry one public television station unless the system had more than 54 channels, in which event the cable system would carry two. Consequently, some public television stations have been dropped by their cable systems, and some contend that this handicaps the growth of public television.[14]

According to a recent survey, cable television carriage was viewed as the most important issue facing them, followed by funding and program promotion.[15]

Millions of children view the elementary and secondary programs provided by instructional television services (ITV). Additional millions of adults receive adult education courses via the system. The public broadcasting community estimates that, "About a third or nearly 800,000 of the nation's school children now regularly use television in school. About 1.5 million teachers use some television for instruction each year."[16]

Instructional programming is carried by 99 percent of public television licensees and most consider this delivery to be an important part of their role.[17] More than 353 hours of original children's daytime programming is produced.[18] Yet, more than 24 percent of the stations wondered if carrying instructional programming was cost effective, suggesting that maybe ITFS or other narrowcasting technology might be more effective.[19]

Most school districts and educational institutions have clear mandates within their own service areas and are developing systems to meet those needs. CPB statistics indicate that ITV is available to about 9 out of 10 school districts. 88 percent have audio/radio programming available for class use. 70 percent have ITV, mostly from over the-air. Almost half of those who use ITV produce some of their own programs. 44 percent of the schools have computers available for use. Out of school media budgets, 15 percent goes to ITV, seven percent to audio/radio, 33 percent to other media, and 45 percent to computers. In general, instructional statistics present a relatively stable picture from 1977 to 1983.[20]

Educational technologies are also becoming more prevalent in the home. According to the Center of Educational Statistics, 99 percent of homes have television, 82 percent audio tape players, and one-fifth of school aged children have computers in their homes.[21]

Video cassettes have an increasing role in the delivery of services in and out of the classroom. Television is used by about one-third of teachers regularly, and almost all schools have VCR's.[22] Quality Educational Data of Denver conducted a survey that indicated 58 percent of U.S. school districts would increase video cassette purchases and 49 percent would buy VCR's if they had available funds.[23] Scholastic Productions predicts that "the children's segment of the prerecorded home videocassette market is expected to be the fastest growing segment of the industry ... increasing to 21 percent by 1990."[24]

Because of the growth and projected growth of educational technologies and their applications, the Instructional Television (ITV) community has over the past several years come to redefine itself as the learning technologies community and created an "ITV Futures" project to look at system-wide planning.[25]

Critical Industry Development

From the early days of educational broadcasting, there was interest in other potential uses of the system. This was particularily true regarding educational television. At the first National Conference on Long Range Financing of Educational Television Stations, held in 1964, the attendees (who represented all the stations) recommended that the White House be approached to look at education television and establish a group for that purpose.[26]

In 1965, the Carnegie Commission on Educational Television was established, with the endorsement of President Lyndon Johnson. Its 15-member task force was to look at educational television, consider what would serve the public interest best, and recommmend what, if any, should be the future of an educational television service. The basis for the initiation of the Public Broadcasting Act of 1967 was the report issued by the Carnegie Commission which built on and expanded the parameters of the successful, but limited, 1962 Act.

The Commission believed that the term "public," rather than "educational" should be used to describe the use of television for noncommercial purposes. It was thought "public broadcasting" better encompassed a broad spectrum of American taste and interest, and was representative of the diversity of American people. On November 7, 1967, President Johnson signed the Public Broadcasting Act of 1967. Public broadcasting was born. Both noncommercial television and radio were included in the Act.

The Act established the Corporation for Public Broadcasting (CPB), for the first time, to provide funds for program production. CPB was established as a private, nonprofit organization, but with its Board of Directors appointed by the President of the United States with confirmation by the Senate. This hybrid, non-governmental structure was planned as a "heat shield" to prevent direct influence on programming decisions by any government officials. It was considered very important to make clear that public stations were not to become a state-controlled broadcasting system.

With a direct appropriation from Congress, CPB was directed to stimulate the development of public broadcasting stations and programming, but was never to own any broadcasting equipment itself or to actually produce any programs. Therefore, CPB began doing its business by creating and giving funds to other organizations to carry out its purposes.

Early in its existence CPB established both the Public Broadcasting Service (PBS) and National Public Radio (NPR) to provide interconnection services to distribute programs simultaneously to all public television and public radio stations. NPR was developed as both a program producer and distribution organization. PBS provided distribution and program acquisition services for public television, but was not established as a program producer.

The CPB began supporting public television and radio programs with grants for national program production shortly after it began operations in 1969.[27]

CPB also established the Community Service Grant (CSG) program to assist the individual stations with general operational support. Appropriations in the early years were small. The first CSGs given to public television stations in 1970 were a flat $10,000 each. Support was given to the operations of 202 stations, through 129 grants to state public television systems, individual station licensees, and to organizations operating more than one station.[28]

Community Service Grants for public radio support were also established by CPB, but first a major study was undertaken to develop a picture of the public radio environment. It showed a poorly funded and loosely organized group of stations. Many stations were licensed to colleges and universities and operated by students. They were used either for training in the communications department or as "sandboxes" for students to operate for their own entertainment. Few provided consistent public service and most had minimal equipment, little or no staff and very poor equipment. In order to set a standard for operational quality, CPB established criteria which radio stations had to meet in order to qualify for Community Service Grants. Only 96 stations could become "CPB-qualified" for the initial grants in 1970, although more than 300 stations were licensed at the time by the FCC to operate noncommercially.[29]

In 1970, the total income for all 202 public television stations was $100 million, and all CPB-qualified public radio stations gathered only $9.4 million. In contrast, there were over 600 commercial television stations operating with income estimated to be 20 times that of their public television counterparts.[30] It was the task of CPB to stimulate the industry and expand service to all Americans. Enthusiasm did grow. New stations went on the air and existing ones gathered new resources.

The rapid growth of noncommercial services in the 1970s also brought differences of opinion within the system about directions and governance. New organizations developed and several old ones disappeared. Any perceived vacuum was quickly filled by an association, regional organization, or other affinity grouping. Stations developed membership organizations for programming, promotion, financial management, and political lobbying. Some of those still active are:[31]

1. National Federation of Community Broadcasters: Founded in 1975 as a nonprofit membership organization of community-licensed noncommercial stations. It provides a wide range of services to its members.

2. National Association of Public Television Stations: A nonprofit membership organization established by public television licensees in 1980 as the sister organization of PBS in nonprogramming areas.

3. Southern Educational Communications Association: One of many regional associations, providing programming, training and other services to its member stations.

4. Central Educational Network: Regional association providing program acquisition services, training and other assistance for members.

5. Organization of State Broadcasting Executives: Composed of managers of large state-supported networks.

By the mid-70s, public broadcasting was in most respects the equivalent of the commercial industry with state-of-the-art facilities. It was also the first to utilize satellite technology. In 1974 public broadcasting began exploring the idea of changing its distribution system from AT&T's terrestrial network to satellite. In 1978, a communications satellite, Westar IV, linked together public television stations throughout the United States, Virgin Islands and Puerto Rico. A year later, National Public Radio was distributing its radio programming via the same satellite.

In 1976, total public broadcasting income had reached $220 million. There were 269 public television stations on-the-air and 176 public radio stations qualified for CPB grants.[32]

Major changes took place for the Facilities Program in 1978, when Congress moved the program from HEW to the Department of Commerce, to be administered by the National Telecommunications and Information Administration (NTIA). At the same time, the Program was renamed the Public Telecommunications Facilities Program and its scope was broadened to include planning and non-broadcast project funding, and to provide special consideration for minorities and women.

Concern by Congress about identifying alternative financing of public telecommunications led to the establishment of the Temporary Commission of Alternative Financing for Public Telecommunications (TCAF) in 1981. TCAF was composed of members of Congress, FCC and Executive Branch representatives, and leaders in public broadcasting policymaking. The TCAF final report was submitted to Congress in July 1982. While TCAF looked at alternatives for financing, they did not identify any alternative schemes as better than the traditional methods. They saw their suggestions as ways to supplement and relieve the pressure of Federal dollars, but recommended that funding continue.

NTIA's Plan for Public Telecommunications Facilities, required under the 1978 Act, was completed in 1982 and concluded that the role of the federal government in funding public telecommunications facilities was fulfilled because service from either public television or public radio was available to about 97 percent of American households.

Concerns regarding funding sources, the role in providing alternative service to the public, and technology utilization will probably remain issues into the foreseeable future.

Growth in Other Educational Uses of Telecommunications

While the "public" side of the industry was growing, the instructional or educational programmers were somewhat overshadowed. The 1967 Act required an examination of instructional technology. A Commission on Instructional Technology was established in 1968 and by October, 1969 a final report, To Improve Learning, was completed. Guidance on Instructional Television Fixed Services (ITFS) and common carrier instructional facilities were discussed generally, but how to utilize the technology specifically was not. Educational uses of technology was to gain and lose popularity throughout the years. It was an area, and to some extent remains an area, where theory never seemed to quite meet up with practice.

By the mid-70s the changes and growth of the system led many associated with public broadcasting to believe it was time to reexamine the system and to look at how to get educational materials out to the public. The Commission on the Future of Public Broadcasting was established in June 1977 by the Carnegie Corporation. The Commission renewed concern on the underutilization of ITFS. Many believed that ITFS technology was capable of providing more unique instructional services than broadcasting. The Congress was also interested in expanding the use of nonbroadcast technologies to supplement broadcasting stations while conserving spectrum space.[33]

In 1979, the Satellite Applications Program, administered by the National Telecommunications and Information Administration, was created to increase public service use of satellite communications by developing systems to deliver public services, training and teleconferencing.

Nonetheless, public television and radio continued to grow and garner most of the publicity. Some public broadcasting stations, however, did become stimulated to look at the wide range of technologies capable of providing both public and instructional services. A number of educational and public broadcasters began work aimed at improving the product of instructional television (ITV). Some success existed in areas where administrators made a serious effort to incorporate ITV into the required curriculum.

Major Trends and Issues

The public broadcasting community has always been contentious and, some say, democratized to a fault. Leadership in public broadcasting has never been laid as a mantle on any individual or organization. The system usually develops an antipathy toward any group within the system gaining more power, money or influence than is necessary to stay solvent. That entity seems to be suspect in the eyes of other stations or organizations. Some believed that CPB would or should become the acknowledged system leader, others that such a role would be inappropriate, but for a variety of reasons, that has not materialized in its almost 20-year history.

According to CPB's President Donald Ledwig, the "biggest hope for public broadcasting financially is to develop new federal and nonfederal funding mechanisms." He continues, "I think that's what we're [CPB] all about: To develop services and then to spin them off and let them run on their own."[34]

Broadcasting has always been the mainstay of the system. Stations are beginning to look at new broadcast services. For example, WNET in New York City, has extended its programming to 24 hours a day.[35]

On the other hand, although public television was the first nationwide satellite interconnection system in the 1970s it has not moved ahead into the forefront of innovative uses for the system or looked at possible ways it can generate money for the system's maintenance or growth. According to a study completed by NAPTS, the public television satellite interconnection system (which was the first such system in the U.S.) will need to be replaced or refurbished in the 1990's.[36] Means to finance the continuation of the system will have to depend on the creative use of the technology to support the fare that we have come to know as "public", educational and instructional telecommunications.

Some U.S. public stations are in contact with the Canadian Broadcasting Corporation, which is the only public broadcasting entity doing High Definition Television (HDTV) work in the hopes of exploring other uses of broadcasting in the future.

Beyond broadcasting are the new media and delivery applications, which are particularly applicable for formal and informal education. Many people believe that a broader use of the various educational systems and technologies can bring students that are underrepresented and in rural areas, as well as those students with family and job commitments, into the educational mainstream.

According to the Department of Education, the United States will spend $1.7 billion per day on education in the 1987-88 school year. The total expenditure is expected to top $300 billion for the average 180-day school year. Education Secretary William J. Bennett, in releasing these statistics, said, "The American people have made a tremendous financial commitment to education. We know what makes for good education; the generous investment is there. It's time we started getting a much better return on that investment."[37]

Some innovative projects using less traditional technology are showing the ability to extend educational opportunities to those who otherwise would be without. Nova University is planning to transmit and receive video, voice and data to remote locations in the U.S. and Caribbean. They contend:

> *Present technology allows students from any location on the globe with telephone service to continue their education via data transfer along packet switching networks. With the advent of Integrated Services Digital Networks (ISDN) the transmission of video images, voice and data along the same communications network will give "telelearning" a dynamic new meaning, and the continued development of satellite technology will free transmission from its present earthbound restrictions.*[38]

Schools and the telephone companies are also developing unique cooperative projects. In Minnesota, public schools and telephone companies are sharing educational and financial capabilities by developing fiber optic projects. Education seeks the ability for interactive alternative delivery systems, and the rural telephone companies are seeking opportunities to upgrade infrastructure and work in strengthening local economic development. The opinion of those taking place in the experiments is that "[T]ime has come for business/educational telecommunications partnerships in rural America...Rural communities will enjoy education and telecommunications services that rival those in urban areas."[39]

These types of enterprises become even more significant given that the number of instructional programs are decreasing, and that by the 1990s the ability to renew and place programming will move to a more dominant position

Another great wave of hope for the use of technology in the classroom is the computer age. Computer literacy for our youth is still considered an important goal for ensuring America's competitiveness in the future The biggest stumbling block for integrating computers into the classroom has been that the majority of teachers are computer illiterate themselves They grew up and were educated before the computer age. Additionally, the school systems and computer marketers have not consistently provided the necessary training. Training and usage will need to be increased to ensure advancement in our educational system.

Members of the Congress are trying to offer assistance that could potentially impact on the future of educational and instructional telecommunications In December, 1987, the Congress passed the Star Schools Program Assistance Act More than $19 million was appropriated to the Department of Education to administer the Star Schools Program. The program provides demonstration grants to telecommunications partnerships (two or more public or private educational entities including public broadcasting stations). These entities are to develop, construct or acquire instructional programming, facilities or equipment The main purpose is to improve the instruction of math, science, foreign languages and vocational education.[illegible]

Many of the options and choices for the public telecommunications system are based on trends of the time. Yet, many look startlingly familiar to alternatives that date back as far as the hearings in the 1950s on how to assist educational, instructional and public communications. Many ideas resurface such as swapping stations, limited advertising or having special taxes. What drives expansion of public telecommunications in the 1990s will be partly creative use of the technology, creative financing, and creative policymaking. Yet in the end what is achieved will depend on the cooperation of the players -- those making the decisions and those affected by the decisions -- to move ahead into the year 2000.

Notes

1. These definitions are a compilation of terms from the FCC's "Telecommunications: A glossary of telecommunications terms," April, 1986.

2. FCC totals as of June 30, 1988.

3. FCC totals as of June 30, 1988.

4. NCTA data as of April, 1988.

5. Robert Summers and Harrison Summers' Broadcasting and the Public, published in 1966. Early noncommercial owners were electronic companies, insurance companies, stores, newspapers, radio repair shops, ballroom or motion picture operators or just individuals who wanted to get their ideas on the air. Initially, the owners did not generate funds, but rather used their own, to operate. After the conferences, it was decided since they were privately owned, they could sell time if they wanted.

6. Ibid, p. 38.

7. In general, in cities which had three VHF assignments, the FCC assigned one of these for educational purposes (unless all three were already occupied.) Consequently, in many of the large cities, educational television began operating on VHF channels.

8. Term comes from John Macy's To Irrigate a Wasteland, published in 1974.

9. Dissertation of M. H. Mitchell, Role of the Federal Government in the Funding of Public Telecommunications Facilities, page 23; 1987.

10. Ibid, page 23. By 1965 the Ford Foundation had contributed more than $96 million to establish educational television stations and to purchase equipment for those stations.

11. Ibid, p. 86.

12. CPB data as of January, 1988. It should be noted that this is only regarding those stations CPB qualified, and not the total number of noncommercial stations.

13. NAPTS statistics, July, 1987.

14. TV Guide, August 8, 1987, p.34.

15. ETV Newsletter, Volume 21, No. 19, September 14, 1987, p.1.

16. "Public Television in the 1990's," National Association of Public TV Stations, July 27, 1987.

17. CPB, Research Notes, April, 1987, number 22, p.1.

18. NAPTS statistics as of July, 1987.

19. ETV Newsletter, September 14, 1987, Volume 21, number 19, p.2. Additionally, ITFS receive sites range from $1,000 to $7,000 per location. Revenue sources can be quite diverse ranging from school budgets, tuition fees, or industry and business.

20. The majority of the statistics regarding ITV come from the CPB, School Utilization Study 1982-1983, in its Final Report.

21. U.S. Dept. of Education, Center for Educational Statistics, Digest of Educational Statistics, 1987, p. 305.

22. NAPTS statistics, July, 1987.

23. ETV Newsletter, Sept. 14, 1987, Vol. 21, No. 19, p.3.

24. Ibid, p. 4.

25. PBS Elementary/Secondary Services, Meeting Old Needs Through Learning Technologies: A long Term Report, Executive Dummary Discussion Draft, July, 1987.

26. Ibid, p. 88.

27. When CPB went about establishing an interconnection organization, it was decided to keep the production of programming and interconnection operations in separate entities. In the late 1960s, National Educational Television was formed, with the financial backing of the Ford Foundation, to produce programs for use by all educational TV stations. Some stations feared that NET might become the dominant programming source for all of public television. However, given CPB's philosophy this did not occur. Instead, NET was eventually merged with Channel 13 in New York City, which became WNET. More information on this can be found in Public Telecommunications Review, Vol. 4, No. 1, (January/February 1976), "The Interconnection Connection: The Formation of PBS". The article was written by Robert Pepper.

28. CPB grants are provided to the entities operating either a single station or a group of stations, so there are always more stations in existence than television CSGs given.

29. CPB has established criteria which all noncommercial broadcasting entities must meet in order to become a CPB member and qualify for financial monies appropriated by the Congress. These criteria are generally regarded as broadcast industry standards and cover staff size, budget, and number of operating hours on-the-air per day. For further discussion see M. H. Mitchell dissertation, p. 155+.

30. A Public Trust, The Report of the Carnegie Commission on the Future of Public Broadcasting, pg. 317.

31. This list is not intended to be exhaustive, but to give examples of the types of organizations now participating in the dialogue about how public broadcasting should proceed in the future. Most of these organizations view themselves as leaders of the system either in a particular region, or specialization, or as important voices in the overall direction of the system.

32. "Public Broadcasting Statistics In Brief," Corporation for Public Broadcasting, February, 1985

33. Congressional paper authored by Harry Shooshan (then Chief Counsel for the House Subcommittee hearings of September 1977) that suggested public telecommunications was not making the most of the varied technologies available.

34. Public Broadcasting Report, September 18, 1987, volume 9, number 19, p.2.

35. Broadcasting, "New Service at Noncommercials," July 27, 1987. p. 98.

36. NAPTS, Public Television in the 1990's, July 27, 1987.

37. U.S. Dept. of Education, News Release, August 23, 1987, "Education Expenditures Soar as School Opens," p.1.

38. Caribbean Telecommunications Council, "Telecommunications and Education," Volume 2, number 1, Summer 1987, p.19.

39. Rural Telecommunications, "Telcos and Schools: Partners in Progress," Winter 1987, p. 43.

40. Federal Register, Department of Education, Applications for New Awards for Fiscal Year 1988 under the Star Schools Program; Notice. Tuesday, April 5, 1988.

XV

Film and Video Industries

by Anita L. Wallgren

The film and video industries have always been characterized by dynamic change but never more so than today. Changes in technology are making the market more competitive, yet offering great opportunities to traditional industry leaders agile enough to take advantage of them.

The program supply business has three basic segments: (1) program producers -- traditionally television networks, independent producers, and movie studios, but also including television group owners in ad hoc consortiums, advertisers and ad agencies, television syndicators, and cable satellite networks, (2) distributors -- often wholly-owned subsidiaries of production companies, which sell products to movie theaters, cable, and broadcast networks, and independent syndicators -- which sell limited exhibition rights to broadcast stations, cable networks, and other outlets; and (3) exhibitors -- the network-affiliated and independent television stations, theaters, and cable systems; and home video retailers.

The ownership of the copyright bundle of rights in each video or film product is usually held by the producer or is broken up into contractually agreed upon pieces between producers and distributors. Film and video products are then licensed, or rented, for various uses. For example, a studio producer might license the domestic theatrical release of a movie to one distributor, the worldwide home video rights to another company, the U.S. network television and syndication rights to another, and to yet another the international broadcasting rights.

Key Industry Statistics

Until the development of videotape, the only audiovisual works were theatrical motion pictures. With each successive new technology came the concern that audiences would abandon the "old" technology. To some extent, each new technology has indeed drawn away some audiences, but overall, new technologies have provided new revenue streams, expanded audiences, and produced more opportunities for film and video suppliers. To some, the unwavering demand for entertainment programming seems to be driving technological developments. For example, some firms have developed the ability to "colorize" black and white films in hopes of creating a new market for hundreds of older motion pictures.

Today, the most important emerging trends are the unprecedented success of several independent producers, the meteoric rise of the home video market, and the expansion of the foreign markets. Tomorrow's most important factors may be the development of High Definition Television (HDTV), high powered direct satellite distribution to theatres and homes, and interactive pay-per-view options.

Theatrical Products

Theatrical motion pictures have been produced and distributed for many years by seven or eight major studios headquartered in Hollywood.[1] Several dozen independent companies also produce films, and about ten of these have established consistent enough records of success to develop distribution subsidiaries.[2] The independents generally rely on the major studios for international distribution and may look to the majors for financing. Joint ventures are increasingly employed for production and distribution of video products.

The motion picture film industry had record revenues in 1987, amounting to over $4.2 billion in box office admissions.[3] The number of admissions has remained constant at about 1 billion for the last twenty-five years.[4] Summer 1987 revenues were exceptionally strong because more than 15 pictures drew over $30 million each in box office receipts, unlike most years when one or two films achieves blockbuster status.[5] The average ticket price has increased as shown in Table 1.[6]

In November, 1987, one theater circuit owner broke yet another price record by raising admissions at certain of its New York City theaters to $7.00 a ticket.[7]

As the U.S. population ages, the number of older movie-goers is also increasing. Although teens still dominate the movie audience, one 1987 study found increases in attendance over 1986 among all older age groups: 30 to 39 year olds, up 9.9 percent; 40 to 49 year olds up 18.6 percent; 50 to 59 year olds up 26.3 percent; and those over 60, up 50 percent.[8]

Although new production was down at the major studios, independent production had boomed so that by the end of August, 1987, 357 films were in production, up 24 percent from 1986, and up 83 percent over 1985.[9] Independent productions increased in 1987 by 37 percent over 1986 and 98 percent over 1985.[10] The average cost of producing a film by the six traditional major distributors and five "mini-majors" in 1986 was $11.7 million. Films produced by independents cost, on average, about $2.5 million.[11]

TABLE 1
Average Theater Ticket Prices

Year	Average Price
1987	$3.86
1986	3.71
1985	3.55
1983	3.15
1982	2.94
1981	2.78
1980	2.69
1975	2.03
1963	0.63

Television Programming

Television programming is not created and distributed in one predictable pattern. In general, the Hollywood movie studios have become essential in the supply of network television programming, either by creating programs themselves or through joint ventures with independent producers (often individuals or small companies with limited network television experience.) Each network negotiates a license fee with the distributor and obtains the rights to exhibit the show a specific number of times (original and repeats), in certain dayparts, for a certain period of time. Typically, a prime time network license agreement grants a network exhibition rights for 22 episodes of a new series, to be aired twice over the course of one calendar year between the hours of 8 and 11 p.m.

About half of the programming aired on broadcast networks is supplied by the major studios. Independent producers,[12] advertisers or sponsors,[13] and other firms are important suppliers of network programming as well. Network programming is valued at $2 to $3 billion annually.[14] The average cost of a new four-camera videotaped half hour situation comedy is about $360,000 each episode. A new one-camera filmed series costs about $500,000 to produce each half hour.[15] Typically, suppliers finance about $100,000 of the cost of each episode while the network or other buyer pays the rest. Some of these series may pay off in syndication, described below, where individual stations may pay over $1,000,000 an episode for the re-run rights.[16]

Not all television programs are produced for the networks. The demand for programming by nonaffiliated (independent) stations to fill their entire broadcast day and by network affiliates for broadcast during non-network hours is met by the syndication market. Two types of syndicated programs have evolved. The most successful shows, generally, are re-releases of series originally aired on the networks, called "off-network syndication", or re-runs. Other shows are initially produced for syndication and are not intended to be aired by the networks; this market is called "first-run syndication."

Successful syndication requires that the supplier/syndicator enter into license agreements with stations in several individual markets so that a specific show will be exhibited to a large audience. National advertisers generally require an audience base of 70 percent of total U.S. households. Because the syndicator needs to assemble a group of stations from the approximately 200 U.S. markets, an effort will be made to sell, or "clear," the show in the largest markets first, to cover the most audience with minimum syndicator effort. The FCC adopted rules in the 1970s prohibiting the networks from holding off-network syndication rights or other financial interests in programming.[17]

The syndication market has fluctuated in the last several years much more than network programming. Again, about half of all syndicated programming is produced and/or distributed by syndication arms of the major studios. About sixty other firms distribute syndicated programming with the total value of programming in the range of $3 to $4 billion annually. The price of syndicated programming increased substantially in the 1980s for a variety of reasons, perhaps most importantly, the increase in the number of independent television stations and the increase in audience ratings for certain syndicated shows (e.g., M*A*S*H). The top price paid for a syndicated program doubled in five years, from $650,000 per episode in 1981 to $1.3 million per episode in 1986.[18]

Revenues from sales of syndicated television programming were expected to decline in 1987 by about 3.7 percent, compared with growth of 17 to 30 percent annually over the previous six years.[19] The decrease in syndication prices was expected for two reasons. First, more than 30 off network or first-run syndicated programs were available for 1988 to 1991, creating a glut of products. Second, many independent stations, the backbone of the syndicated buying market, had overextended themselves in program commitments. Prices for syndication rose dramatically in the 1970s and 1980s, but stations, believing it was essential to acquire some of the "hot" situation comedies, made commitments which they had trouble fulfilling, particularly since advertising revenues did not increase a great deal in 1987.

Theatrical movies are funnelled through pay cable (e.g., HBO, The Movie Channel), independent television "premiere" packages, and other sources before appearing on network television today. Thus, network prices for theatrical motion pictures have declined. The networks are now paying, on average, about $3 million for a theatrical movie, about half of what they were paying four or five years ago.[20] In contrast, the number of made-for-television movies has increased, from 117 in the 1984-85 season to 162 in 1985-86. The average Nielsen rating for made-for-tv also increased from 16.4 to 17.2, while Nielsen ratings on average, decreased for theatrical movies on network tv, from 14.3 to 14.2.[21]

Some theatrical films are being sold to ad hoc networks of stations for their first television exposure. Distributors hold back the right to sell some advertising time to national advertisers, which may amount to $900,000 from two plays on the stations.[22] This practice of a distributor retaining the right to sell advertising in a program is called "barter" syndication.

The value of advertising placed in barter syndication (theatrical packages, game shows, first run syndicated series, and other programming) amounts to about $800 million annually and is expected to continue its hearty growth into the 1990s. Barter and cash-plus-barter (in which the broadcaster pays some cash while the distributor keeps a portion of the advertising inventory) have developed in response to market demands. These practices permit broadcasters to either acquire programming with no cash payment (beneficial for new stations or new, untried programs), or to budget a predictable cash outlay for programming. If a show becomes a hit, the barter arrangement may keep the cash at the same level, while permitting the syndicator to hold back an increased amount of advertising time.

In addition to the thriving first run broadcast syndication business, increasing amounts of programming are being created for cable networks as well. HBO, Showtime, The Disney Channel, Lifetime, and the USA Network have all begun to produce, finance, or purchase original documentaries, specials, series, and events. These cable services are also buying their share of syndicated off-network broadcast fare formerly available only to broadcast stations.[23]

Important sources of noncommercial programming also include a number of cable services such as C-SPAN, which transmits live coverage of the U.S. House of Representatives and Senate and other public affairs programming and local coverage of state and local governments, school boards, and other public activities.

Home Video

The newest step in the sequential release of film and video product has developed in the form of prerecorded video cassettes for sale and rent. Nationwide, about half of all U.S. homes had a videocassette recorder (VCR) in 1987, about double the penetration levels of just two years ago. The A.C. Nielsen Co. noted that markets with the highest VCR penetration were Fairbanks, Alaska (75.6 percent), Anchorage, Alaska (73.5 percent) and Las Vegas (62 percent). In major markets, Nielsen reported that 61.4 percent of Los Angeles homes had VCRs, 58.2 percent in New York, and 59.3 percent in Chicago.[24] The number of video retail outlets jumped from 13,000 in 1984 to 24,000 in 1986, but had grown by only 3,000 in the first five months of 1987.[25]

The relatively new home video business has become very important in a very short time, with revenues from sale and rental of videocassettes surpassing theatrical admission revenues in 1986. In 1987, 47 films generated $10 million each in sale and rental revenues and 20 earned $20 million each.[26] Combined sales and rentals reached $7.2 billion, a 57 percent increase from $4.6 billion in 1985.[27] What may be more important, however, is that the percentage of the studios' net income from home video has equalled or surpassed the studios' mainstay, domestic film rentals.

For example, a financial analyst recently projected that Paramount's 1986 income could be broken down as follows:[28]

TABLE 1
Projection of Paramount's Sources of Income

Domestic film rentals	$320,000,000	(37.1%)
Foreign film rentals	120,000,000	(13.9%)
Home video	207,000,000	(24.0%)
Pay cable	120,000,000	(13.9%)
Network TV	96,000,000	(1.1%)

The analyst noted that home video would contribute 24 percent of income, a striking amount since the industry virtually did not exist a mere decade ago.

Critical Industry Developments

We turn now to a discussion of regulatory,oadcasting Rules established in the 1940s were repealed in 1977 because of changed circumstances in the radio industry, the Commission reiterated its view that "licensees have an affirmative, nondelegable duty to choose independently all programming they broadcast."[38]

It was a similar concern that television affiliates might be supplanted by networks in control of programming that led the Commission in the 1960s to adopt several rules governing television network relationships with affiliates,[39] including: a two year limit on the term of an affiliation agreement; prohibition of exclusive affiliation agreements; prohibition of territorial exclusivity; prohibition of a network obtaining options to fill enumerated portions of affiliates' time; a requirement that an affiliate must have a right to reject carriage of network programs; and barring the networks from control of station rates for non-network time. Networks were also prohibited from representing their affiliates for sale of spot advertisements.

In the early days of television, most programs were financed and produced by local stations and advertising sponsors. By the 1960s, however, production had largely shifted to the major studios and control over program selection had shifted to the networks. This shift was due to skyrocketing production costsd a 50 percent interest in the Cineplex-Odeon theater chain; Gulf and Western (parent of Paramount Pictures) purchased the Trans-Lux, Mann Theaters, and Festival circuits.[32] Columbia Pictures (not party to the consent decrees) has also made a major investment in movie theaters. Additionally, MCA, Inc. entered the television ownership business with the high priced purchase of "superstation" WOR, New Jersey, for $387 million.[33] Twentieth-Century Fox acquired the largest group of non-network affiliated television stations in the country owned by Metromedia, in 1985. Lorimar-Telepictures purchased stations in Pittsburgh and Indianapolis in 1986.[34]

In the decades following the Paramount decrees, the advent of television drastically eroded moviegoing audiences. By 1967, box office receipts hit their all time low, less than $1 billion on 553 million paid admissions.[35] Although the development of television seriously wounded the theatrical film business, television has created an important market for theatrical films. In addition, the studios began producing television programs, a multi-billion dollar business.

In 1943, the U.S. Supreme Court held that the FCC had power to make rules denying licenses to those who engaged in certain network practices.[36] It should be noted, however, the Commission does not license network operations, only the broadcast outlets which the networks may own and operate. The courts and the FCC since the 1940s have attempted to address concerns that the networks exert excessive control over television programming.

The public has benefited from network development through their delivery of many hours of entertainment and new programming. Many stations would otherwise be unable to afford the high costs of programming. In the 1940s, however, the Commission found that the radio networks attempted to lock affiliates into network programming schedules, preventing them from making independent programming selections.[37] Although several of the Radio Chain Broadcasting Rules established in the 1940s were repealed in 1977 because of changed circumstances in the radio industry, the Commission reiterated its view that "licensees have an affirmative, nondelegable duty to choose independently all programming they broadcast."[38]

It was a similar concern that television affiliates might be supplanted by networks in control of programming that led the Commission in the 1960s to adopt several rules governing television network relationships with affiliates,[39] including a two year limit on the term of an affiliation agreement; prohibition of exclusive affiliation agreements; prohibition of territorial exclusivity; prohibition of a network obtaining options to fill enumerated portions of affiliates' time; a requirement that an affiliate must have a right to reject carriage of network programs; and barring the networks from control of station rates for non-network time. Networks were also prohibited from representing their affiliates for sale of spot advertisements.

In the early days of television, most programs were financed and produced by local stations and advertising sponsors. By the 1960s, however, production had largely shifted to the major studios and control over program selection had shifted to the networks. This shift was due to skyrocketing production costs, as viewers quickly became sophisticated and demanded "network quality" programming, with expensive sets, more than one camera, and other production elements. Advertisers found production costs too high and determined that selective purchasing of television advertising time in several different programs was a more efficient way to reach targeted viewers. The networks played increasingly important roles in program financing, development, and distribution through the 1960s and 1970s.

The FCC engaged in studies of network television in the 1950s (the Barrow Report)[40] and again in the 1970s (the Network Inquiry.)[41] In 1970, the FCC adopted three rules specifically aimed at limiting network control over program acquisition, with the intent to stimulate new production sources. The primetime access rule

(PTAR) limits affiliated stations to airing three hours of network programs during the primetime hours of 7 - 11 p.m. The FCC also prohibited the networks from entering the domestic syndication market for any program, or from entering foreign syndication for programs produced by non-network suppliers, and, finally, prohibited the networks from holding other financial interests in programs produced by non-network sources.[42]

In 1974, the Department of Justice initiated antitrust actions against each of the networks for alleged anticompetitive practices in the program supply market, which resulted in three consent decrees.[43] Among the terms of the consent decrees, limits were set on the amount of programming each network may produce itself, the network's ability to acquire financial interests in revenues from uses other than network exhibition, participation in syndication, and the term of years for which a network may hold an option to renew a show.

These rules governing network-supplier practices have been controversial. The consent decrees will expire in 1990; an effort by the FCC to modify or repeal the syndication and financial interest rules was put off indefinitely in 1984; and there appears to be no movement towards reexamination of the primetime access rule. The rules governing network affiliate practices remain unchanged. A special limitation on network ownership of stations was discussed but not adopted in the 1985 modification of the ownership rule, so that an entity, including a network, may control 12 television stations, so long as no more than 25 percent of the total U.S. audience is reached by the television broadcast signals.[44]

The number and types of exhibition media have exploded in the 1970s and 1980s while program licensees and purchasers have continued to negotiate "exclusive" rights to programs. Cable television systems, through importation of distant television signals, undermined the geographic exclusivity broadcasters had acquired in their contracts for non-network and syndicated programming. This led the FCC to bar importation of distant signals by cable systems and to establish rules protecting a broadcaster's exclusive right to air syndicated programming in certain markets, plus rules limiting the exhibition of duplicative network programming and certain professional sports events.[45] Although the distant signal prohibition and syndicated exclusivity rules were repealed in 1980,[46] the FCC recently concluded a rulemaking to reimpose syndicated exclusivity protection.[47]

Exclusivity has become important not only for broadcast stations, but for many cable networks as well. HBO and Showtime, the two most popular "premium" movie channels available on cable systems, actively bid against each other for the exclusive right to packages of theatrical films and professional sports games. HBO recently outbid Showtime by offering $500 million for rights to 85 Paramount Pictures films.[48] These pay cable services have become major forces in the film and video industry because of their demand for the product and their ability to pay for it. HBO alone has spent more than $3 billion on motion picture licensing fees and almost $1 billion on other original programming since it started about 12 years ago.[49]

Although the "products" made for television may be somewhat different than the products made for theatrical distribution and although forms of distribution of those products have become more diversified, it is essentially a single industry that develops and produces filmed and videotaped entertainment programming. That industry, one detractor claims, controls 92 percent of all theatrical film rentals, 65 percent of all videocassette sales, over 50 percent of all prime time network programming, at least 45 percent of the syndicated broadcast program market, and 74 percent of pay cable service program payments, plus 14 percent of all theatres and at least 33 percent of the nation's television stations.[50]

A small number of companies exert substantial influence over the development, production, and distribution of video and filmed programming, although dominance among those firms changes from year to year and there is a good deal of entry and exit from the industry.[51] One significant factor affecting market power in the film and video industries has been the rise of independent filmmakers.[52] Companies like Cinecom, Hemdale ("Platoon"), Island Pictures, and Kings Road Entertainment have enjoyed critical and financial success in recent years. Almost $1 billion in new outside funding has gone to independent companies in the last two years.[53] The independents lack distribution arms, however, and generally make arrangements with the major studios for distribution and promotion which can be as expensive as the costs of production. Some independents are taking more control over distribution of their films, even when studios are involved. They may do all the planning and marketing, purchase prints (typically $1,000 each for 35 mm films) and advertising, and simply pay a fee for the use of the studio's distribution system.[54]

Technological advances, particularly in the area of high definition television (HDTV), may provide opportunities for producers to reduce costs and develop innovative creative techniques.[55] Satellite transmission techniques for HDTV are also being developed which might also radically alter traditional distribution of film and video products.

Some firms have sought to create a new market for older motion pictures by "colorizing" hundreds of black and white films. Supporters of the practice say they are bringing classic films to a whole new generation that would otherwise be ignorant of them. Opponents of colorization say the process defaces an artistic work.[56]

Substantial growth in the use of VCRs is dramatically altering the programming industries. Early opinions ranged from a belief that television and moviegoing would be entirely replaced by home viewing on VCRs, to a belief that there would be no impact on television viewing and moviegoing habits. Under current copyright law,[57] the studios make a profit on the first sale of recorded videocassettes, and retailers keep the fees from rentals. Congress has considered modification of the so-called "first sale doctrine"[58] but has left it intact so far. In 1987, Jack Valenti, President of the Motion Picture Association of America, the driving force to modify the first sale doctrine so that the producers could share in revenues from VCR rentals, conceded defeat on the issue. Some observers believe that MPAA members are making enough profits on the sale of VCR tapes to diminish their desire to fight home video retailers on the rental issue.

The home video business has matured in just about five short years and, by some accounts, its future is uncertain. One industry observer said that "unless it finds a way to guarantee video will be the best means to get recent theatrical films into the home, or develops powerful alternative programming of its own, this multi-billion-dollar business could find itself in deep trouble someday."[59] The first possibility raised, continuing the role of home video in providing recent theatrical releases, may be eclipsed by pay-per-view cable services which offer recent theatrical releases without the need to go to a video store to rent a cassette. The second possibility, creation of more home video original programming, is an expensive proposition that may not succeed with viewers. A survey of consumer attitudes revealed that the main reason consumers chose pay-per-view over cassette rental was convenience, according to 43 percent of those surveyed. Other factors in choosing pay-per-view were: impulse decision to watch (12 percent); wanted to record movie (9 percent); video store out of title (7 percent). Those surveyed who chose cassette rentals cited price as the most important factor (38 percent), convenience of scheduling viewing (23 percent); were unaware of pay-per-view option (14 percent); liked going to the store (4 percent).[60] At present, theatrical releases account for 95 percent of home video rental revenues and 55 percent of revenues from sale of units.[61] The biggest "sell-through" success to date has been "Top Gun", which is estimated to have sold 1.95 million cassettes[62] at $26.95 per cassette.[63] Today pay-per-view is a $50 million a year business, while home video generates $3 billion a year, but those figures may change rapidly.[64]

International Developments

Combined with the development of the home video market, the most significant change in the film and video industry in recent years has been the increasing importance of foreign markets. In one company's recent annual report, the typical range of possible uses for film and video products was as follows:

> Domestic Theatrical: With few exceptions, films play first in movie theaters in the United States and Canada. The strategy of when and where a film opens is individually designed to maximize each film's theatrical rentals...and its ultimate earning potential, since success in the theatrical marketplace strongly influences performance in subsequent markets.
>
> International Theatrical: Films generally are released next in international theaters. Openings are staggered from country to country, taking into account film and local market conditions. In certain cases a film may be re-released in the theatrical market, either domestically or worldwide.
>
> Worldwide Home Video: After theatrical release in a given country, a film usually is released for home entertainment on videocassette and videodisc.
>
> Worldwide Pay Television: Another home entertainment market is pay television, an important market in the United States and an emerging one internationally. Films are licensed to pay television services and distributed to homes via cable or over-the-air transmission.
>
> Domestic Television: Most films are licensed to television networks for a specific number of airings over a certain number of years. In the syndication market, films are licensed to independent and network-affiliated stations.

A film may return to pay television after appearing on a network or in syndication.

International Television: In the international marketplace, films are licensed to broadcast television following theatrical, home video, and where available, pay television distribution. Films generally are licensed territory by territory for a specific number of airings over a given time period.[65]

International sales have increased for several reasons such as the trend towards broadcast privatization in Europe, worldwide deregulation, and growth of media outlets. Although the number and kind of international outlets are rapidly proliferating, the creditworthiness of foreign networks, television stations, and new satellite services may vary considerably. Most distributors license older material to outlets abroad at prices lower than U.S. transactions would yield[66] but still are doubling or tripling revenues from international distribution.[67]

Increasing distribution outlets have created a greater incentive by licensees to protect whatever exclusivity they might have obtained through their program contracts. In contrast to the U.S. where program licensees and suppliers sought regulatory limitations at the FCC, European licensees are trying to protect their rights through contractual provisions. For example, contracts with the BBC or ITV broadcast networks in the United Kingdom prohibit the supplier from selling the specific program to cable or satellite users.[68] One additional factor in Europe is the presence of language differences which serve as de facto limits, for example, on the exclusive French satellite transmission of French-language programming. The problem is most serious for English-language programming which can be popular throughout much of Europe and which, therefore, is not frequently found on satellite services.

The first ratings survey of European satellite services revealed that about 18 percent of European viewers watched 5 to 7 different stations. Nonetheless, two English language satellite services, Sky Channel and SuperChannel, are said to be losing money. Sky Channel is reported to have lost $30 million over its five year existence. One difficulty may be that some European countries restrict the purchase of advertising on these services, thus undercutting the normal effect of the strong ratings.[69]

Contrasting growth in legitimate international sales, piracy of film and video products has been, and continues to be, a serious problem. "Piracy" involves unauthorized distribution of copyrighted materials without attempting to pass it off as legitimate, including unauthorized satellite transmissions, cable retransmissions, VCR and sound recording "bootlegs" and other unauthorized copies. Piracy can also include "counterfeit" materials, unauthorized copies which distributors package and sell as the real thing. Piracy occurs for several reasons, including (1) cultural differences in countries where intellectual property is not perceived as having the same degree of property rights as tangible property; (2) low risk of being caught and/or penalized versus high potential financial rewards; and (3) consumer demand that outstrips supply from legitimate sources. Although the U.S. encourages the free flow of information across national borders, adequate levels of intellectual property protection must be ensured.[70]

In the U.S., pirated home video material is valued at $180 million per year at wholesale prices,[71] or 5 - 10 percent of the retail market.[72] Worldwide, the problem is perhaps most serious in Japan, where piracy of film and video products of U.S. firms is estimated at $170 million annually and pirated products from Japanese firms is estimated at $230 million.[73] Brazil has been trying hard to turn around its home video market from 85 percent pirated in 1986. Brazilian officials are hopeful that unauthorized copies of home video cassettes will decline to only 20 percent of their market by the end of 1987.[74] Other home video markets, e.g., Cyprus consist of 100 percent pirated home video material.[75]

American companies dominate the creation of entertainment programming, worldwide. The trade surplus for film and video products has been estimated at $1.2 billion annually,[76] with sales of television products alone amounting to $500 million in 1986.[77] Another estimate is that film and television exports amounted to $2.5 billion to $3 billion in 1986.[78] Sixty percent of the $2 billion film market is in Europe.[79] There is huge demand abroad for U.S. products, but often the governments of other countries employ various means to limit U.S. access to their markets. Five of the most common and serious tactics include:[80]

1. Quota limitations on U.S. products -- laws may limit the number of titles imported or distributed or the number of prints or cassettes imported or distributed; laws may require an amount of "screen time" be devoted to national products; similarly, many countries require a certain amount of broadcast programming originate domestically.

2. Inadequate intellectual property protection -- copyright laws may be unenforced, out of date, inadequate, or nonexistent, thereby permitting widespread piracy and counterfeiting.

3. Service barriers -- discriminatory laws may require that products to be exhibited in a given country must be printed or reproduced in that country or may prohibit U.S. firms from opening local offices for distribution.

4. Import Duties and Tariffs -- excessive and/or discriminatory tariffs are often levied on U.S. products.

5. Subsidies -- governments create incentives by tax laws, loans, trade promotion agencies, and other means which favor domestic products, to the disadvantage of U.S. firms.

Canada is the largest supplier of foreign programming in the U.S. as well as being the largest buyer of U.S. programming beyond our borders. The Canadian total box office was estimated at $380 million (Canadian) for 1987, of which about 80 percent was attributable to U.S. theatrical releases; about $180 million (Canadian) was be paid last year for rights to television programming produced outside Canada, the majority of which was produced in the U.S.; and about $165 million (Canadian) will be spent on wholesale home video products provided entirely by U.S. firms.[81]

Although the U.S. and Canada recently completed a Free Trade Agreement, the Canadian Government announced its intention to restrict the distribution of U.S. film and video products in Canada because of the Canadian policy of promoting their own cultural industries. This type of discriminatory government action has strained relations in the past and has been protested by President Reagan and the U.S. Senate.[82]

One of the sources of tension between the U.S. and Canada has been the Canadian government's authorization of the Cancom satellite service to retransmit U.S. broadcast signals to cable systems throughout Canada. Since Canadian copyright law does not impose liability for either the satellite retransmission or cable retransmission of audio visual works carried in those signals, the U.S. copyright owners are not compensated for the Canadian performance of their works.

Major Trends

Revenues from theatrical exhibition may continue to increase, although probably due to admission price increases, not expansion of audiences. Sumner Redstone, a successful theater owner recently warned the National Association of Theater Owners (NATO) that comfortable, well-equipped theaters may not continue to pull people in from their homes. "We would be stupid if we did not see that greater home-viewing flexibility, particularly the eventual development of high resolution tv and pay-per-view, will encourage tv-related social gatherings, and that these in turn may reduce the significance of out-of-home, mainly the motion picture theater, entertainment."[83] Nonetheless, one industry analyst predicts a compound annual growth rate in revenues of 7.2 percent through 1991, when theatrical box office revenues should equal $5.6 billion.[84] The number of production starts should dramatically increase as studios release existing titles for themselves and other producers, and video distributors increasingly create new titles to maintain product flow.[85]

The demand for video products should be intensified over the next several years because of the growing number of homes equipped with VCRs and cable television. The biggest question is whether demand for cable and VCR programming will shift original products away from traditional network and syndicated television. Because of some of the problems facing independent television in particular, one expert predicts that syndication prices will drop from 10 percent for high-demand programming in sheltered markets to 50 percent for marginal programming in markets where bidding wars have resulted in inflated prices.[86] One firm predicts that VCR penetration will increase from 49 percent in 1987 to 63 percent in 1988, and to 67 percent by the end of 1989.[87] With VCR penetration growing faster than cable TV penetration, it is estimated that by 1995, over 80 percent of U.S. homes will have a VCR.[88]

Although the picture for film and video products is bright, it is somewhat dimmed by skyrocketing production costs. Since 1980, the average cost of making a theatrical movie has risen 113 percent, not including marketing and advertising costs.[89] Production costs associated with video programs have also increased substantially. Rising costs will likely continue while producers search for solutions, including such cost containment strategies as making some or all of the production in Canada or co-venturing with European producers.

The home video market, many believe, will have to shift its focus from VCR rentals to retail sales in order to meet the challenge of a maturing industry and pay-per-view cable programming. One firm estimates revenue growth from combined rental and sales, and the dramatic shift in rental to sell-through units as follows:[90]

TABLE 3
Projected growth of Home Video Market

Year	Units Sold (Million)	Rental Units (Million)	Total Revenue ($ Billion)
1987	60	62	3.3
1988	88	63	3.8
1989	118	61	4.0

Feature films will likely be the continuing source of home video fare, although more made-for-home-video programming will be created.

One analyst believes "There's going to be a major consolidation. By 1995, it wouldn't surprise me to see three major enterprises embracing 80 percent of the broadcast and entertainment business."[91] Vertical integration is evident in the cable and independent television business, as Viacom, Fox, and Time, Inc. all have made substantial investments in production, distribution, and exhibition.

One industry analyst forecasts an annual compound growth rate for film and video revenues of 13.6 percent between 1987 and 1991. Domestic spending by TV stations to acquire programming, the firm predicts, will amount to $10.4 billion by 1991.[92] The firm believes the biggest change in the industry has been that volatile box office performance no longer determines the total revenues as much as it sets the tone for videocassette rentals and TV sales. They caution that the film and video industries have a serious problem in trying to control costs, compounded by a growing asset base.

Looking farther into the future, the film and video sector may be radically altered by the advent of fiberoptic delivery systems to the home, capable of delivering film and video products on an interactive, on-demand basis. Like the threat posed to theatrical film by the coming of television, posed to terrestrial broadcasting by cable television, to cable television by videocassettes, and to videocassettes by pay-per-view programs, broadband fiberoptic technology may threaten existing distribution modes, but may also significantly expand the markets for film and video products.

Consumer demand for film and video products appears to be leading technological developments in the distribution of these products. Buyers and sellers of film and video products are faced with new opportunities for growth, simultaneously, they face increased competition in their traditional lines of business. A new video marketplace is emerging as old labels and predictable relationships fall away. These business changes are occurring in an environment where consumer choices and changing lifestyles are putting pressures on program suppliers and underwriters to respond quickly and effectively. The industry is facing a period of experimentation in which many new suppliers may introduce new products and marketing strategies.

Notes

1. In 1987, the members of the Motion Picture Association of America, Inc., were Columbia Pictures Industries, Inc.; The Walt Disney Company; De Laurentis Entertainment Group, Inc.; MGM/UA Communications Co.; Orion Pictures Corporation; Paramount Pictures Corporation; Twentieth Century Fox Film Corporation; Universal City Studios, Inc.; and Warner Bros. Inc.

2. For example: New World, Buena Vista, Tri-Star, New Line, Cannon Films, Lorimar, and Island Films are some of the distributors of current independent theatrical releases.

3. "Fall B.O. Rising to Record High Point", Variety, November 11, 1987, p. 3.

4. Paul Kagan, cited in "Boffo Box Office from Vidcassettes", Insight, November 23, 1987, p. 8, at 14.

5. "Yep, Summer '87 Boxoffice is a Winner", Variety, September 9, 1987, p. 3. The story also noted that the current strong box office trend had lasted for 16 months, and should last through 1988, based on past industry cyclical performance.

6. 1987, 1986, 1985, 1975, and 1963 average prices from "Exhibs Still Mixed Over $7 Tab; Tentative on Nationwide Effect", Variety, November 18, 1987, p. 7; all other prices from 1985 Statistical Abstract, Table 383, p. 227.

7. "Exhibs Still Mixed Over $7 Tab; Tentative on Nationwide Effect", Variety, November 18, 1987, p. 7.

8. Opinion Research Corp., in "West Clients Confident Entering New Year,: Adweek, January 4, 1988 at 6.

9. "Production is Back with a Vengeance", Variety, September 9, 1987, p. 5.

10. Id.

11. "Hollywood Feature Costs Up Only 6%", Variety, July 2, 1986, p. 5.

12. E.g., Steven Cannell, Norman Lear, and Aaron Spelling.

13. E.g., Procter and Gamble and other advertisers have sponsored the "soap operas" for many years. Hallmark and other firms sponsor special high quality productions to enhance their corporate images.

14. Estimate based on industry sources.

15. "Sitcom Budgets Squelch Laugh Track", Variety, October 14, 1987, p. 189.

16. Id.

17. 47 C.F.R. 73.658(j) (1986). See discussion infra.

18. "Hollywood, broadcasters, cable battle it out over syndex", Broadcasting, July 27, 1987, p. 37.

19. "Give-backs to ailing stations causing new syndication woes", Channels, April, 1987, p. 14.

20. "As Webs Close Doors on Theatricals, Majors Use Other Windows", Variety, August 13, 1986, p. 33.

21. "As Webs Close Doors on Theatricals, Majors Use Other TV Windows," Variety, August 13, 1986, p. 33.

22. Id.

23. "Cable Subscribes to Original Programming", Broadcasting, October 12, 1987, p. 50.

24. "VCR Boom Leveling Off", Electronic Media, June 1, 1987, p. 25.

25. "As Video Soars, Vestron Slips", New York Times, May 23, 1987, p. 33.

26. Communications Daily, February 24, 1988 at 6.

27. U.S. Industrial Outlook 1988, Entertainment, p. 66-5, U.S. Department of Commerce.

28. "Wall Street Plugs in VCR Potential," Variety, September 23, 1987, p. 1.

29. See Conant, The Paramount Decrees Reconsidered, 44 Law and Contemp. Prob. 79 (1981).

30. United States v. Paramount Pictures, 334 U.S. 131, 161-66 (1948).

31. Id.

32. "Supplement One to 'The Compulsory Cartel': How Hollywood is Muscling Independent Theaters, Producers and Television Stations", National Cable Television Association, April 6, 1987, p. 3.

33. "Hollywood Seeks Control of Outlets", New York Times, March 3, 1986, p. C14.

34. "The 'Compulsory Cartel'" A Survey of the Motion Picture Studios' Drive for Dominance Over Program Supply and Exhibition", National Cable Television Association, November, 1986, pp. 29-30.

35. Pearce, Telecommunications Information Industry at p. 114, cited in Telecommunications in Transition, U.S. Congress, House Committee on Energy and Commerce, 1981, p. 281.

36. National Broadcasting Co. v. United States, 319 U.S. 190 (1943).

37. Id., at 199, 203, 205-06.

38. Report, Statement of Policy, and Order, 633 F.C.C. 2d 674 (1977).

39. 47 C.F.R. 73.658 (1986).

40. Network Broadcasting, Report of the House Committee on Interstate and Foreign Commerce, 85th Congress, 2d Session (1958).

41. Commercial TV Network Practices, Notice of Inquiry, 62 FCC 2d 549 (1977). The Final Report of the Network Inquiry special Staff was consolidated in two volumes, hereinafter referred to as "Network Inquiry."

42. 47 C.F.R. 73.658(j),(k) (1986), Network Television Broadcasting, Report and Order, 23 FCC 2d 382 (1970).

43. United States v. Columbia Broadcasting System, Civil Case No. 74-3599-RJK (C.D. Cal., Dec. 10, 1982); United States v. American Broadcasting Companies, Civil Case No. 74-3600-RJK (C.D. Cal., Dec. 10, 1982); United States v. National Broadcasting Co., 449 F. Supp. 1127 (C.D. Cal. 1978), aff'd mem., No. 77-3381 (9th Cir., Apr. 12, 1978), cert. denied, 48 U.S.L.W. 3186 (1979).

44. Report and Order in Gen. Docket No. 83-1009, 56 R.R. 2d 859 (1984).

45. Cable Television Report and Order, 36 FCC 2d 143 (1972); ("distant signal rules") 47 C.F.R. 76.59(b), 76.61(b)-(f), and 76.63 (1980); ("syndicated exclusivity rules") id. 76.151-76.161 (1980); ("network nonduplication rules) id. 76.92-99 (1980); ("sports blackout rules") id. 76.67 (1980).

46. Report and Order in Docket No.s 20988 and 21284, 79 FCC 2d 663 (1980), aff'd sub nom. Malrite T.V. of New York v. FCC, 652 F.2d 1140 (2d Cir. 1981).

47. Notice of Inquiry and Notice of Proposed Rulemaking, Gen. Docket No. 87-24, 2 FCC Rcd 2393 (1987); Report and Order, FCC No. 88-180 (released July 15, 1988).

48. "The HBO-Showtime Struggle for Hollywood Films", Broadcasting, July 27, 1987, p. 38.

49. "Cable's Interest in 'Hollywood's Best'", Broadcasting, October 26, 1987, p 98.

50. The "Compulsory Cartel": A Survey of the Motion Picture Studios' Drive for Dominance over Program Supply and Exhibition, National Cable Television Association, November, 1986, p ii.

51. In 1985, the members of the Motion Picture Association of America were Columbia Pictures, Embassy Communications, Walt Disney Productions, MGM/UA Entertainment Co., Orion Pictures Company, Paramount Pictures Corporation, Twentieth Century Fox Film Corporation, Universal Studios, Inc., and Warner Brothers, Inc., in contrast with current members, see note 1, supra.

52. "Boffo Box Office from Vidcassettes", Insight, November 23, 1987, at 11.

53. Id.

54. Id.

55. "Gotham Duo Pegs Hope on High Definition TV," Variety, July 8, 1987.

56. "Retailers Say Black & White More Popular Than Colorized Versions," Variety, August 3, 1988, p. 50.

57. Copyright Act of 1976, Sec. 109, 17 U.S.C., Sec. 109 (as amended), Pub. L. 98-450, 98 Stat. 1727 (October 4, 1984).

58. Id.

59. "Vid Industry Acts and Feels Its Age", Variety, August 26, 1987, p. 33.

60. "Pay Per View Hurts Home Video, Video Software Dealers Assn. Says", Communications Daily, August 19, 1987, p. 5-6.

61. "Sell Through, Not Rentals, Central to Future Growth, CBS/Fox Sez" Variety, November 25, 1987, p. 39.

62. Jack Valenti, "So Much Done, Yet So Far to Go", Speech before the annual convention of the Video Software Dealers Association, August 17, 1987.

63. "Home video vs. cable in Vegas", Broadcasting, May 25, 1987, p. 41.

64. "The Pay-Per-View Blues", Electronic Media, August 24, 1987, p. 10.

65. 1984 Annual Report of the Coca-Cola Company, p. 30.

66. "TV Indies See O'Seas Sales Boom", Variety, October 14, 1987, p. 1.

67. "Overseas Sales Have Become Essential," Electronic Media, February 22, 1988 at 142.

68. Id.

69. "Euro Satellites To Survey Viewers", Variety, July 22, 1987; "Euro Birds Go Begging for Viewers", Variety, August 26, 1987, p. 77.

70. An omnibus trade bill, passed by the Congress in 1988, included provisions that would require the President to engage in talks with trading partners who fail to combat piracy. "House approves Bill to Battle Piracy in Film, Record Industries," Variety, July 22, 1988 at 7.

71. Jack Valenti, "So Much Done, Yet So Far to Go", Speech before the annual convention of The Video Software Dealers Association, Las Vegas, Nevada, August 17, 1987.

72. "MPAA Releases Report on Antipiracy Campaign", Variety, October 21, 1987, p. 510.

73. "Yanks' Fight Against Vid Piracy Holds Lesson For Japan, Says Nix", Variety, October 14, 1987, p. 154.

74. "Brazilian Industry Goes Straight As Legal Product Finds Shelves", Variety, November 4, 1987, p. 32.

75. Report to the United States Trade Representative on Trade Restrictions Facing the MPEAA Member Companies in Foreign Markets, Motion Picture Export Association of America, Inc., May 1987.

76. "Trade Barriers to American Film Product", Motion Picture Export Association of America, Inc., 1987.

77. "The Empire Builders", Channels, April, 1987, p. 36.

78. "U.S. Works to 'Safeguard Intellectual Property'", Washington Post, December 6, 1987, p. H1, at H4.

79. "Panel Outlines Hurdles to European Program Sales", Broadcasting, November 9, 1987, p. 89.

80. Id.

81. "U.S. Hold On Canadian Market", Variety, November 25, 1987, p. 43.

82. "Canada Vows to Pass Legislation Curbing Power of U.S. Distribs Despite Bilateral Free Trade Pact", Variety, November 25, 1987, p. 43

83. "Redstone Decries 'Complacency' of Exhibs in Couch-Potato World", Variety, November 25, 1987, p. 7

84. Veronis, Suhler & Associates, quoted in "Cable Growth Accelerates", Broadcasting, November 30, 1987, p. 94

85. "Prebuys Keeping the Cameras Rolling", Variety, November 4, 1987, p. 3, at 93.

86. "Give-backs to ailing stations causing new syndication woes", Channels, April, 1987 p. 14.

87. "Sell-Through, Not Rentals, Central To Future Growth, CBS/Fox Sez, Variety, November 25, 1987, p. 39

88. Communications Daily, March 22, 1988 at 3

89. "The Movie Moguls Reel Off One More Tale of Big Bucks," Wall Street Journal, February 24, 1988 at 30

90. "Sell-Through, Not Rentals, Central To Future Growth, CBS/Fox Sez", supra.

91. David Londoner, quoted in "Movie and TV Mergers Point to Concentration of Power to Entertain", The Wall Street Journal, August 21, 1986, p. 1

XVI

Consumer Electronics

by Thomas V. Wasilewski

In defining consumer electronics, an official U.S. trade classification system -- the Standard Industrial Classification (SIC) -- includes television receivers, radios, phonographs, video cassette recorders (VCRs), audio tape recorders, stereo system components, and automobile radios and tape players.[1] Other products considered consumer electronics but which fall under other SIC codes are video cameras, television antennas, video games and cartridges, electronic calculators, home computers and software, citizens bands radios, remote control devices, home security systems, radar detectors, telephones, and telephone answering devices.[2] This industry currently offers consumers an overwhelming number of products for entertainment, information, and education. Rapid technological advancements will continue to offer consumers innovative products that will affect how we play and work.

Key Industry Statistics

Factory sales of consumer electronic products (including other items than the SIC classification) in the United States for 1987 were estimated at $30.4 billion compared to $29.7 billion in 1986, and $8.2 billion in 1977.[3] A large majority of the $30.4 billion in factory sales came from video -- $13 billion. Sales for other consumer electronics included $8.1 billion for audio, and $8.5 for home information equipment and related products. By 1988, factory sales for consumer electronics are expected to reach $32.2 billion.[4]

Video Statistics

i) Television. In 1987, television sets -- color, monochrome, and projection -- accounted for $7.1 billion in factory sales. Of the $7.1 billion, color televisions accounted for $6.3 billion while monochrome TVs sales were $0.3 billion and projection TVs $0.5 billion.[5]

The shipment of television sets accounts for 72 percent of consumer electronics produced in the United States.[6] With a French electronics company, Thomson, purchasing General Electrics' (G.E.) consumer electronics division in 1987 (which included the RCA brand purchased by G.E. in 1985), however, Zenith has become the only major U.S.-based manufacturer of TVs. Domestic production of color TVs declined in 1986 by an estimated 1.3 percent; while in the first half of 1986 imports of color TVs increased 39.2 percent compared to the first half of 1985.[7] Color TV sales to dealers for April 1987 were up 14 percent over April 1986 and up 8 percent over last year's four month period.[8] The 1987 Committee on Nationwide TV Audience Measurement conducted a phone survey of 3000 households and found that 1 in 4 households have 3 or more TV sets while 3 of 5 households have 2 or more TV sets.[9] With approximately 90 percent of all households having a color TV, about 40 percent of the 17 million color sets expected to be sold in 1987 will be replacements for older models.[10] Many consumers will be purchasing an additional set, thus accounting for 50 percent of television sales.[11] With continued enhancements to television including stereo and better picture quality, color TV sales are expected to be $6.3 billion in 1988.[12]

ii) VCR. The video cassette recorder (VCR), developed by a U.S. company, was first introduced in 1975. The VCR gives the consumer the capability to be his own programmer. The owner can select a movie, tape an event and watch the particular program at his or her convenience. VCRs conform to one of three standards -- VHS, Beta, and 8mm. VHS and Beta use tape that is a quarter inch wide while the 8mm is considerably smaller and is more suitable for portable applications. In 1987, VCRs sales were $5.1 billion compared to 1986 sales of $5.3 billion, and 1985 sales of $4.7 billion.[13] Since 1975, VCRs have outpaced color TV sales and it is

---

estimated that over 52 percent of U.S. homes have a VCR.[14] Nielsen listed as markets with highest penetration of VCRs: Fairbanks, Alaska 69.5 percent; and Las Vegas 63.3 percent.[15] In 1987, VCRs have had a slighter higher household penetration rate than cable television although the VCR penetration rate is highest in homes with cable TV.

Although there are no U.S.-based manufacturers of VCRs, some Japanese manufacturers have started production of VCRs in the United States because of the favorable exchange rate. Hitachi assembled approximately 100,000 units in 1986 at Anaheim, California.[16] In 1987, an estimated 230,000 units were produced in the United States -- less than 1 percent of worldwide Japanese production. Some experts project nearly 900,000 VCRs will be produced in the U.S. by 1989.[17] Thomson, with the recent purchase of G.E.'s consumer electronics division, is competing with Matsushita for the top spot in sales of VCRs in the United States.[18]

iii) **Video Camera**. A new type of portable VCR, the one-piece camera-recorder combination "camcorder" has replaced two-piece portables in popularity. The camcorder enables the user both to record and play tapes. The camcorder's versatility allows the owner to film almost anywhere and then return home, connect the camcorder to the television, playback the recording, and use the unit as a typical VCR. Beta, VHS and 8 mm camcorders are available. More than 1.19 million video camcorders were sold in 1986 compared to only 167,000 two-piece portables.[19] Most of the current camcorders owners already own home VCR decks and are seeking a unit which is very portable and easy to use. The popularity in the one-piece camera-recorder continues to grow. For April 1987, sales reached 104,000 units -- a 103 percent increase over the 53,000 sold to dealers in April 1986. For the first four months of 1987, camcorder sales have increased over 50 percent compared with the same period last year, i.e., the first four months.[20]

Audio Statistics

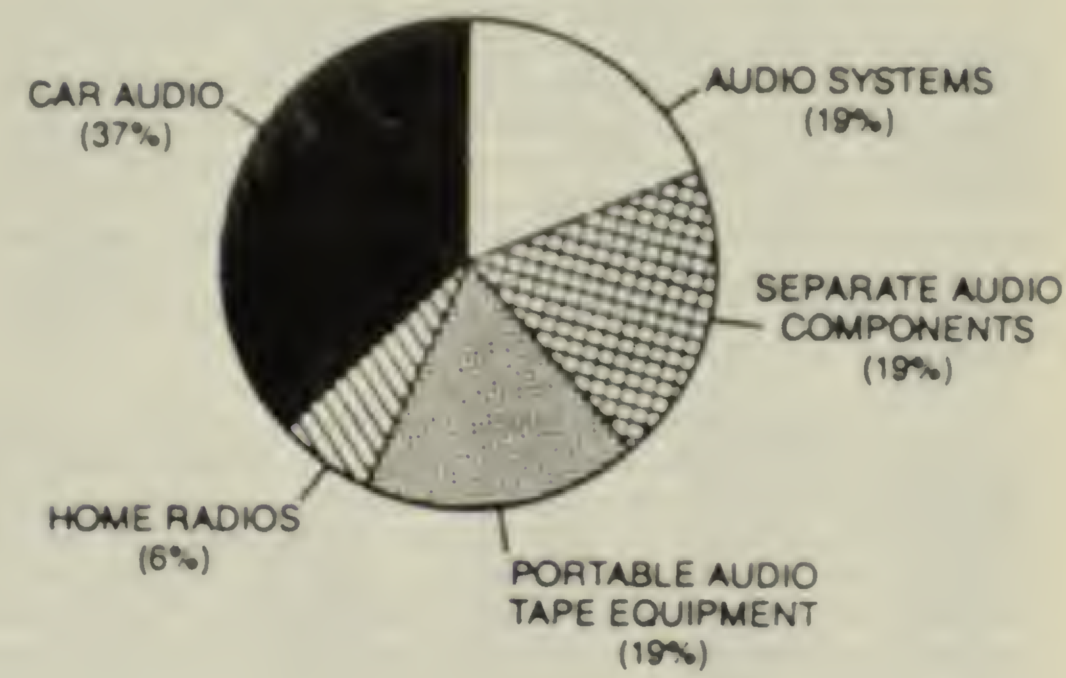
i) **Radio**. In 1986, factory sales of radio units (which includes home radios such as the table, clock, and portable models and automobile units) were $2.1 billion. Sales of table, clock and portable radios reached 25.4 million units compared to the 21.6 units in 1985. Sales of automobile radios (including radio/tape combinations) increased to 15.8 million units.[21] Table 1 provides a breakdown by product for the 1987 factory sales of audio equipment. For 1987, car audio equipment is supposed to account for 37 percent of factory sales of audio equipment while home radios will account for another 6 percent. The number of AM stereo units on the market is small. Most receivers are produced exclusively for reception of C-QUAM or Kahn, although multi-standard receivers are available (e.g., Sony and Sansui). Motorola asserts that the 7 to 8 million C-Quam compatible receivers constitute about 98 percent of the AM stereo market; AM stereo radios only comprise 2 percent of all AM radios in the United States.[22] The number of radio units sold in 1986 was 41.2 million compared to the 37.1 million sold in 1985.[23]

Although not as large as the AM/FM radio market, the other frequency band radio sets have interested many consumers as the prices for these units decline. These sets include: 1) shortwave units which allow the owner to listen to broadcasts around the world; 2) marine band units for ship-to-shore conversation; and, 3) scanner radios which search various communications bands -- police, fire, aircraft, and cellular telephone -- and stop on active channels to allow the owner to listen.

ii) Audio Equipment. For 1987, 3.8 million audio systems were sold for $1.05 billion, and in 1986, 4.8 million audio systems were sold accounting for $1.37 billion in factory sales.[24] Audio systems are packages that offer the consumer one-stop shopping in obtaining a home sound system. In the past, most audio systems were placed inside a cabinet, but these audio systems are being replaced by the manufacturers' offering of separate elements set in a stand. Other consumers have decided to establish their own system and purchase equipment from different manufacturers. The sale of separate audio components reached $1.36 billion in factory sales for 1986. Estimates are that sales of separate components for 1988 will be $1.45 billion compared to the projected $1.01 billion for one-brand component systems.[25]

Compact Disc (CD) players are separate components which deserve to be highlighted. The factory sales of CD players continue to impact the audio components market and Table II shows the growing popularity of this new audio component. The compact disc player uses laser technology to read information from a 4 3/4" disc (12 cm). The disc contains millions of microscopic bits that can store up to 74 minutes of music. The compact disc player offers a significant improvement in sound quality and the discs are much more resilient. Since entering the market in 1983, the CD player's growth has surpassed all other consumer products including the VCR.[26] In 1984, it is estimated that 208,000 units of compact disc players were sold to dealers in the U.S.; by 1986 CD sales reached 3.0 million units. The prior number include home CD players, audio systems sold with CD players, autosound CD players, and portable CD players. In 1986, 1.69 million home CD players were sold to dealers for $338 million. By 1988, the factory sales of home CD players is expected to reach 2.8 million units.[27]

TABLE 1



FACTORY SALES OF
AUDIO EQUIPMENT
1987

Source: Electronic Industries Association

Home Information Statistics

i) Telephones and Accessories. The factory sales of telephone sets declined in 1986 to an estimated 28.5 million units for $1.1 billion at an average value of $39. The 1984 factory sales were estimated at 30.3 million units for $1.2 billion and average value of $41.[28]

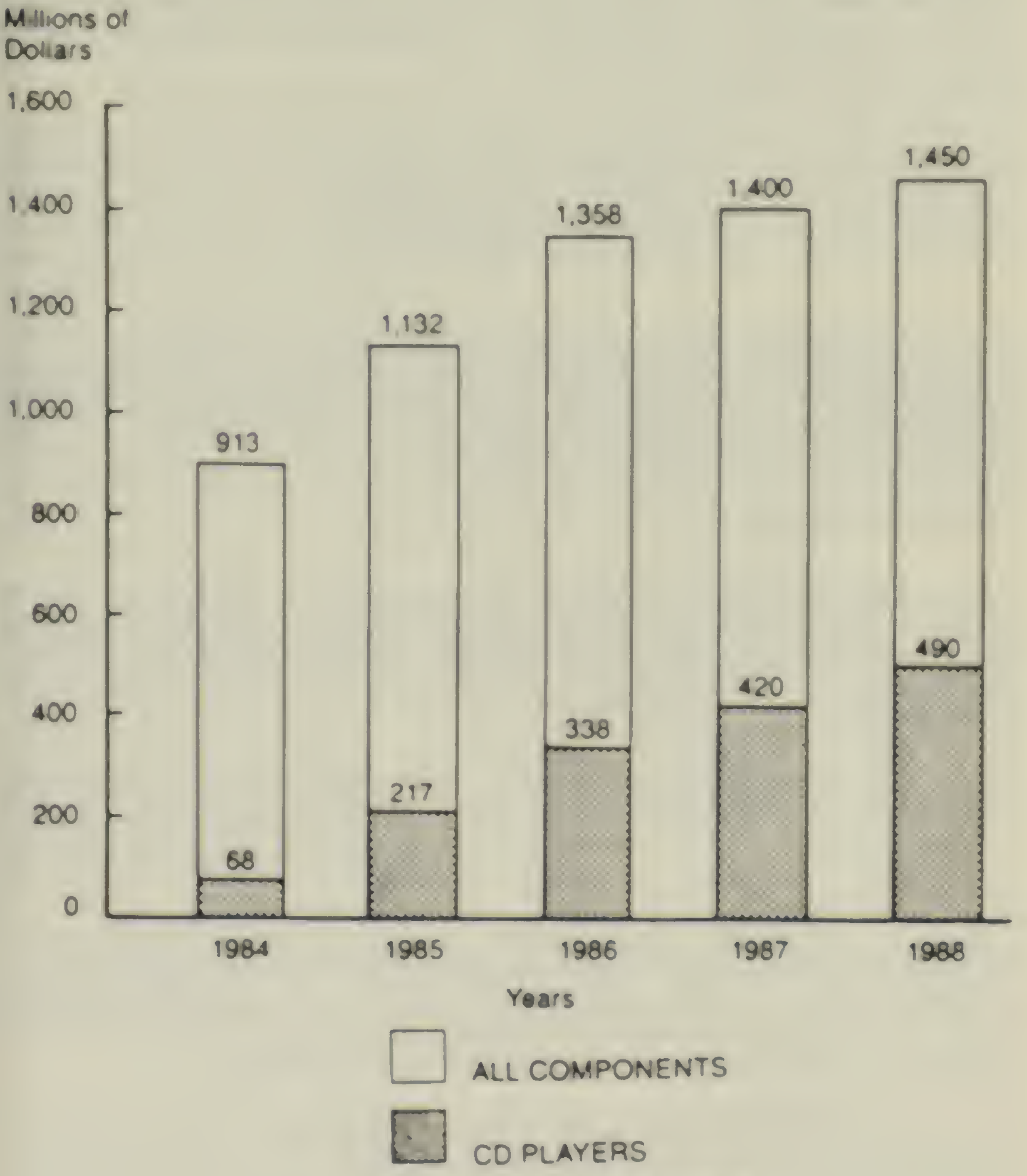
Since the introduction of cellular telephone service in 1983, it continues to be primarily used by businesses because of the high cost of equipment and fees for installation and use. In the future, however, it is expected that cellular phone costs will decline and will become more attractive to the average consumer. A typical cellular phone cost $1,200. In addition, the user can expect a $25 to $50 fixed monthly charge and a usage charge of $.35 to $.50 per minute. The estimated number of cellular units sold to dealers in 1987 was 300,000 units with a total factory sales value of $265 million, a 7 percent growth over 1986.[29]

Consumers purchased approximately 4.9 million telephone answering machines; the average price was approximately $72. For 1987, sales reached 5.8 million units, an 18 percent increase over 1986.[30] By the end of 1988, the number of telephone answering machines sold is expected to reach 6.3 million units.[31] Mr. Friel, Group Vice President of Electronic Industry Association's (EIA) Consumer Electronics Group, noted that approximately 15 percent of the households have an answering machine.[32] A relatively new product, the facsimile/telephone -- "faxphone" -- transmits documents over the telephone line. The price for a faxphone ranges from $1,000 to $2,000. The faxphone is being marketed for the small office and is beginning to enter many homes.

ii) Home Computers. Home computers, classified by EIA as those selling for less than $3,000, rebounded in 1987 to 4.1 million units, up nearly 8 percent from 1986 sales of 3.8 million units. Computer software sales were expected to reach $1 billion in sales compared to $800 million. After a period of flat sales, the new strength in home computer sales reflects a more "computer-wise" buying public and the emergence of a new "cottage industry": the home office.[33] These home computers are not only offering new forms of home entertainment, but are helping consumers to streamline finances and even create a thriving home business industry.

TABLE 2

FACTORY SALES OF SEPARATE AUDIO COMPONENTS



Source: Electronic Industries Association

The use of personal computers is growing at the home and at work. By 1988, an estimated 37.5 million personal computers will be in use: nearly one for every six U.S. individuals.[34] With the use of a modem, the home and business computer user can access a wealth of information. It is estimated that 4.4 million personal computers in the U.S. today have communications modems that allow access to online information services via the telephone line.[35] InfoWorld Magazine predicts that the percentage of U.S. households with a PC and modem will increase from 4 percent in 1986 to 13 percent in 1990.[36]

Critical industry Developments

The rapid growth in consumer electronics has been very recent, with the market quadrupling in the past decade. The consumer's choice for household entertainment was limited primarily to the radio in the 1920-50s, with television emerging since the early 1950s. Technological advancements have been the main reason for rapid growth in consumer electronics.

Historical Overview

i) **Radio.** In 1895, radio signals were transmitted over short distances by an Italian engineer named Guglielmo Marconi. By the turn of the century, radio signals were successfully transmitted over the Atlantic. The first practical use of the radio was for ship-to-ship and ship-to-shore communications. Radio broadcasting, as we know it today, started after World War I.

By the early 1960s, 40 years after radio's introduction, microelectronics technology significantly reduced the size of the radio receiver. A major breakthrough was the invention of the transistor in 1947 by AT&T's Bell Labs. Despite technological advances, however, the overwhelming majority of radio receivers sold in the United States were limited to the AM band. Although FM stations were licensed as early as 1941, FM was unable to make substantial inroads into the dominance of AM radio until the latter part of the 1950s. FM radio's difficulties were attributable, in part, to AM's well-established position in the radio market and the lack of separate programming on FM channels. For consumers, FM radio meant having to purchase receivers more expensive than AM receivers.

By the 1960s, however, due to procompetitive Federal Communication Commission (FCC) policies and technological advances, FM radio began to flourish. In 1955 for example, the FCC authorized use of the subcarrier portion of the FM signal. This "subsidiary communications," as it was called, allowed nonbroadcast services to be transmitted by FM stations in order to generate revenues.[37] The

Commission took further steps to enhance FM radio when in 1965 it prohibited duplicative programming on co-owned and co-located AM-FM stations as a means of increasing FM diversity.[38] Perhaps the most important development in the growth of FM radio however, was the development of stereo technology. In 1961, acting on the request of the National Stereophonic Radio Committee, the FCC adopted an FM stereo transmission system standard.[39]

With the development of stereo technology and improvement in listening quality to consumers, music format stations have flourished since the 1960s. As expected, the result has been significant new demand by consumers for FM stereo receivers. The growth in FM radio has been so significant in the past 20 years that as of 1984, the number of FM licenses and construction permits was greater than for AM (5,141 TO 4,880) and in many metropolitan areas, FM stations attracted a majority of the listening audience.[40]

In an effort to enhance the competitive position of AM radio, the FCC in 1982 authorized AM stereo, but left it to the marketplace to determine an industry standard.[42] While declining to select a single standard, the 1982 Order did establish minimum technical rules to prevent spectrum interference and ensure stereo performance levels. A 1987 study by NTIA noted that the AM stereo market was stagnating.[43] Fewer than 10 percent of the nation's AM stations have adopted stereo, and the growth rate in new stereo stations seems to be slackening.

ii) **Television.** Television has many fathers including Karl Ferdinand Braum (German inventor of the cathode-ray scanning device -- late 19th century), Vladmir K. Zworykin (Russian inventor of the first TV camera tube -- 1923), and Philo Farnsworth (U.S. inventor of the first electronic TV system in 1927). In 1927, Secretary of Commerce Herbert Hoover participated in an experimental television broadcast between New York and Washington. The first black and white TV sets were shown at the 1939 World's Fair (RCA sold these sets later that year for $625). The first color broadcast was in 1954, the first videotape recording was in 1956, and the solid state color set were available in 1967.

A major event in the consumer electronics/home entertainment market occurred in the 1950s with the introduction of commercial television. In the first five years of television (1947-1952), few households had receivers due to the lack of stations on the air and the expense of purchasing a receiver. In 1948, the lack of television channels became evident and the Federal Communications Commission stopped allocating television in order to examine how to improve and extend TV service. In 1952, the FCC rejected a proposal by an existing television network (Dumont) to have television based on a relatively small number of powerful regional stations. Instead, the FCC decided upon a system which would consist of a large number of local television stations to serve as "mouthpieces" for their respective communities. In this 1952 decision, the FCC also chose to develop television broadcasting making use of both the Very High Frequency (VHF) and Ultra High Frequency (UHF).[45] During its introduction, the cost for a television set placed it out of reach of many consumers. In 1950, for example, the average factory cost of a new monochrome television receiver was $190. By 1985, however, the factory cost of monochrome television receivers was down to $82.

For those households that could afford television in its early years, viewing choices were limited to the VHF band (channel 2-13). Although the FCC approved allocations for UHF channels (14-83) in 1952,[44] throughout the early 1960s, most television sets were still being produced without UHF tuners. To aid the development of UHF television, Congress passed the All-Channel TV Receiver Act in 1962, which required all new television receivers sold after April 30, 1964 to be capable of receiving UHF as well as VHF channels.[45] The FCC took additional action steps in the 1970s to foster greater parity between the two services with regard to picture and noise quality and channel selectors.[46]

The next major change in television receivers was the introduction of color television. Although the FCC first gave approval to a color television standard in 1949,[47] legal challenges and lack of enthusiasm among set manufacturers and the public stalled color's growth. CBS did manufacture color sets beginning in 1951 using the field sequential system, but this system was incompatible with existing monochrome television sets. RCA introduced "compatible color" and the Commission adopted this standard in 1953. By 1964, only 1.4 million color receivers were produced, compared with 7.1 million monochrome receivers.[48]

By 1986, however, color television receivers have become the dominant product of the consumer electronics industry, with factory production at 19.0 million units (over three-quarters of all receivers produced) and valued at $6.3 billion. Sales are expected to continue at a steady pace in the coming years as technology greatly enhances the quality of reception as well as creates new uses for television receivers.

Many consumer electronics -- video, audio, and home/office products -- emit radio frequencies. In the United States, the FCC is the government agency responsible for managing the private use of the spectrum. The radio spectrum is an intangible and valuable resource. The FCC allocates spectrum to a variety of services. After these allocation decisions, it is not unusual for equipment and service providers to claim that not enough spectrum has been reserved to allow certain services to be offered. However, the careful management of the spectrum by the FCC often results in products which utilize the spectrum in an efficient manner.

Since the FCC is responsible for managing a large portion of the radio spectrum in the United States, the agency is concerned with equipment which emits radio frequencies. Personal computers, modems, and cordless telephones must meet certain requirements of the FCC rules. One section of the rules, Part 68, establishes nationwide technical standards for telephone and data equipment designed for interconnection to the telephone network. Part 68 protects the network from harmful interference to the network, but performance, reliability, and quality features are left to the discretion of the user and the marketplace. Another section of the FCC rules, Part 15, limits radio emissions of devices utilizing digital circuitry in order to minimize the potential of interference to television and radio communications. In the United States, product certification and testing is mainly the responsibility of the manufacturer. The FCC uses five types of approval, but only a very limited number of these items are tested by the FCC. Most approvals by the Commission are based on test data supplied by the manufacturers.

b) **Current Issues**. Technological advances continue to shake the consumer electronics market. With the move from an analog to a digital world, people will continue to notice considerable changes in consumer electronics -- such as significant improvements in television and audio systems. Doing more than just improving the sound system, recent technological developments with compact discs are expected to offer other applications to the household and business.

i) Composition of U.S. Consumer Electronics Industry. The consumer electronics industry is composed of more than 430 companies which manufacture color television sets, phonographs, automobile radios, loudspeakers, and microphones. Most monochrome TVs, VCRs, and portable radio are imported to the U.S. There are no U.S. manufacturers of VCRs, but with the dollars' decline in value and the increase of the yen, several Japanese firms have located assembly plants in the U.S. Currently, all CD players are being manufactured overseas.

The U.S. balance of trade in consumer electronics has registered a deficit since 1972. The trade deficit in 1985 was estimated at $10.8 billion, a 25 percent increase over the 1984 deficit of $8.6 billion. The U.S.-based consumer electronics industry steadily collapsed after substantial competition from mainly Asian-based manufacturers. In 1984, U.S.-based manufacturers supplied 45 percent of U.S. apparent consumption, and by 1987, the U.S.-based manufacturers' share of the market was reduced to an estimated 39.5 percent.[49] From 1985 to 1972, the disparity between imports and exports increased at a compound annual rate of 12.4 percent.[50]

Table III shows the U.S. exports and imports of consumer electronics goods from 1978-1987.

TABLE 3

Imports of Consumer Electronic Products (Thousands of Units and Dollars[1]); United States, 1978-1987

YEAR	COLOR TELEVISION UNITS	COLOR TELEVISION DOLLARS	MONOCHROME TELEVISION UNITS	MONOCHROME TELEVISION DOLLARS
1978	2.775	577,089	5,931	350,858
1979	1,369	302,564	5,874	342,644
1980	1.293	311,785	6,172	387,857
1981	1.984	501,424	6,246	404,425
1982	2.228	545,584	5,521	343,648
1983	4,849	797,240	5,281	292,104
1984	6.441	1,089,266	6,462	360,347
1985	7,685	1,113,770	6,381	349,111
1986	9,755	1,525,192	6,556	325,323
1987	9,886	1,499,983	5,220	263,024

YEAR	AUDIO SYSTEMS UNITS	AUDIO SYSTEMS DOLLARS	HOME AUDIO TAPE RECORDERS/PLAYERS UNITS	HOME AUDIO TAPE RECORDERS/PLAYERS DOLLARS
1978	4 312	231,883	19,301	790,358
1979	3.801	203.229	19,087	831,576
1980	2.932	153,312	21,866	919,364
1981	3.437	198.209	26.646	1,280.057
1982	2.122	160,195	26,367	1.182,304
1983	2.536	161.090	29,149	1,175,977
1984	2.586	188.730	38,117	1,440,572
1985	3.286	385,906	37,695	1,436,647
1986	3.047	766.576	30,501	1,040,490
1987	3 642	1,146.183	43,793	1,196,903

YEAR	HOME RADIOS UNITS	HOME RADIOS DOLLARS	AUTOMOBILE RADIOS UNITS	AUTOMOBILE RADIOS DOLLARS
1978	37,935	627,749	5,439	184,471
1979	28,998	491,519	4,431	165,658
1980	29.874	486,304	3,394	118,985
1981	33 514	549.433	3,567	144,253
1982	33,744	543,221	3,605	167,337
1983	38,637	567,429	4,507	257,495
1984	48,935	655,615	4,871	299,718
1985	43,501	609,763	5,035	311,357
1986	40,455	532,987	3,665	209,155
1987	39 238	583,577	2,999	168,696

YEAR	AUTO TAPE PLAYERS UNITS	AUTO TAPE PLAYERS DOLLARS	VIDEO CASSETTE RECORDERS/PLAYERS UNITS	VIDEO CASSETTE RECORDERS/PLAYERS DOLLARS
1978	10 507	471 595	586	299,051
1979	10,491	480,002	681	361,624
1980	9,362	423,280	940	498,333
1981	10 786	545,003	2,000	999,725
1982	10 512	496,386	2,462	1,031.966
1983	13.423	640.729	4,760	1,605,771
1984	16 388	893,657	9,377	2,852,737
1985	18,483	1,083,562	16,262	4,165,103
1986	17,956	1,146,560	17,605	4,403,711
1987	17,407	1,207,103	13,305	2,895,846

[1] U.S. Customs value.

SOURCE: U.S. Department of Commerce

Exports of Consumer Electronic Products (Thousands of Units and Dollars[1]), United States, 1978-1987

	COLOR TELEVISION		MONOCHROME TELEVISION	
YEAR	UNITS	DOLLARS	UNITS	DOLLARS
1978	410	143,946	223	24,281
1979	375	133,914	156	11,479
1980	788	276,982	165	20,845
1981	644	230,295	280	28,730
1982	381	138,939	138	16,639
1983	297	93,804	52	6,770
1984	267	92,632	78	8,044
1985	207	85,808	101	11,561
1986	357	118,955	77	10,947
1987	490	165,795	96	12,335

	AUDIO SYSTEMS		HOME AUDIO TAPE RECORDERS PLAYERS[2]	
YEAR	UNITS	DOLLARS	UNITS	DOLLARS
1978	336	58,049	516	38,865
1979	298	50,705	438	54,053
1980	219	57,118	467	65,111
1981	194	52,005	837	66,091
1982	146	39,394	379	50,245
1983	49	14,737	133	27,963
1984	65	16,745	121	30,403
1985	129	25,947	103	34,691
1986	251	34,587	172	93,394
1987	362	45,001	291	46,712

	HOME RADIOS		AUTOMOBILE RADIOS	
YEAR	UNITS	DOLLARS	UNITS	DOLLARS
1978	835	21,491	795	58,623
1979	887	26,075	508	30,142
1980	594	20,718	505	47,216
1981	560	19,005	775	72,616
1982	413	11,075	750	71,592
1983	279	9,210	742	73,884
1984	404	10,898	816	98,050
1985	523	13,098	695	75,904
1986	700	17,025	802	79,414
1987	1,006	21,391	1,009	100,480

	VIDEO CASSETTE RECORDERS PLAYERS	
YEAR	UNITS	DOLLARS
1978	4	11,644
1979	6	81,131
1980	9	76,087
1981	13	81,205
1982	20	77,363
1983	8	51,908
1984	6	58,435
1985	28	92,798
1986	37	94,379
1987	41	[illegible]

[1] U.S. Customs Value [2] Excludes office type.

SOURCE: U.S. Department of Commerce

Although Japan was the overall leading supplier of consumer electronic products with $102.5 billion sales in 1986, color television sets arriving from Taiwan accounted for 30 percent of U.S. television imports in 1987. Japan was the leading importer of compact discs and compact disc players (60 percent of 1987 U.S. CD imports) and VCRs (87 percent of 1987 U.S. VCR imports).[51]

In the United States, domestic color TV shipments account for approximately 72 percent of total domestic shipments of consumer electronics. For 1986, over 47 percent of the television sets sold in the United States were supplied by three companies -- RCA/GE with 23 percent of the market, Zenith with 14.5 percent, and North American Philips with 9.5 percent.[52]

In 1987, the United States position in consumer electronics declined further with the sale of General Electric and RCA to France's Thomson S.A. With the sale, Zenith has become the only major U.S. manufacturer of television sets while Thomson becomes the leading supplier of television sets in the United States.

The World's Top TV Set Makers[53]
1986 color TV production, millions of units

Philips (Netherlands)	8.2	Hitachi (Japan)	3.1
Thomson* (France)	6.8	Samsung (S. Korea)	2.5
Matsushita (Japan)	4.7	Zenith (U.S.)	2.0
Sony (Japan)	3.8	Sanyo (Japan)	1.8
Toshiba (Japan)	3.2	Sharp (Japan)	1.7

*Includes 4.6 million units made by GE, RCA, and Ferguson.
Data: BIS Mackintosh

Thomson has given no indication of making major changes to the operations of GE and RCA and the major production center will remain in Indianapolis. Japanese competitors have established plants in the United States because of the recent exchange rate between the yen and the dollar as well as to avoid U.S. custom duties for TV units.

Zenith, the only U.S. producer of television sets, does most of its manufacturing in Chicago and Missouri, but has facilities in Mexico for assembling its smaller sets. Zenith relies upon the success of its computer business. Zenith's television business has experienced losses for the past two years and is just breaking even this year.[54] Zenith is hoping that its flat television tube will revive its television business. However, Zenith is considering a number of options with regard to its consumer electronics, including possible joint ventures, and divestiture.[55]

In 1986, Japanese companies produced over 6 million television sets in the United States, which is 18 percent of Japanese production worldwide. Japan's two largest suppliers of TV sets (Matsushita, and Sony) have plants located in

Washington, California, and Illinois. Hitachi, JVC, Toshiba, Sharp, Sanyo, and Mitsubishi also have plants in the United States.[56]

With the exception of Zenith and U.S. producers of computers and cellular telephones, consumer electronics is primarily dominated by foreign companies. While it seems unlikely that the U.S. could once again become a leader in consumer electronics (in the near future), the United States should consider ways in which to encourage more companies to establish or expand their manufacturing plants in the United States.

ii) Television. In July 1987, the Federal Communications Commission initiated a proceeding to examine advanced television systems and determine the possible impact on existing television broadcast service.[57] In the Notice of Inquiry, the FCC identified several technical limitations to the U.S.'s current television system referred to as the National Television Standards Committee (NTSC) system. The FCC's proceeding will consider possible enhancements to the current NTSC system as well as other enhanced television systems that have developed new transmission technologies. With this proceeding occurring at the time this overview was completed, an advanced television broadcasting system could be a reality in the not too distant future. Some of the recent advances in television technology are:

Improved NTSC systems. Industry groups are working on new standards to enhance current picture quality (e.g., line, color, contrast) by improving the broadcasting system. An existing television set would still be able to pick up the broadcast, but a new television or a modification to the set might be necessary to receive an enhanced picture. A possible option mentioned in the FCC proceeding is to adopt an improved NTSC system.

High Definition Television (HDTV). This would provide a far sharper image than current television because of its large number of electronic-scanning lines and dots called picture elements, or pixels. A high definition signal broadcasts 1,125 and 1.5 million pixels per screen. The standard U.S. signal sends 525 lines and 212,520 pixels. HDTV's screen design is wider than the common TV set and this modification will enhance the visual drama in televised movies and sporting events. These radical changes to the current television set provide an image that has been compared to that of a quality 35 mm film that you see at the theatre. The first high-definition sets are expected to reach the U.S. market no earlier than 1991 and initially cost between $3000 and $4000 - at least until mass production and competition bring prices down.[58] The delay in HDTV is due to difficulties in selecting a worldwide production and transmission standard. The FCC is examining a means of broadcasting HDTV information. The Japanese have developed a method for transmitting HDTV signals and plan to introduce the transmission system, referred to as MUSE, in 1990. Unfortunately, MUSE is incompatible with North America's NTSC broadcasting system. Since HDTV contains much more information, the HDTV signal requires twice as much frequency as a conventional television signal requires. MUSE and other systems compress the signal for broadcasting, but the signal requires more frequency than the current TV channel. The Japanese intend to build receivers which display both HDTV and NTSC pictures.

Projection TV. Although not new to the market, these large screen TVs (34" to 10 feet in diagonal measurement) have experienced technical improvements which offer a sharper picture. Rear-projection models display the picture from inside the cabinet and have become more popular than the front-projection systems. Even with these enhancements to projection televisions, April 1987 projection TV factory sales were 10 percent off the prior years sales.[59]

Digital Television. The digital television receives analog video/audio signals, automatically encodes them into digital information, and eventually decodes them back into analog signals to the picture tube and speakers. Digital sets are free of flicker common with analog sets and may be able in some cases to double the number of lines scanned, thereby increasing picture quality (referred to as enhanced resolution). Introduced in the U.S. market in 1985, these sets start at $1000 and let you manipulate video images such as watching two shows simultaneously -- one program fills most of the screen while the other is in a small corner box. Also, it is conceivable in the future that a digital set will allow you to freeze a picture and zoom into a certain part of the picture. It is estimated that by 1992 up to 40 percent of color television sets sold in developed nations will be digital.[60]

Liquid Crystal Display (LCD) Television. Long used in watches and calculators, liquid crystal displays are now being employed as television screens. Some experts predict that by the end of the century, half of all televisions will use LCD technology since LCD TVs will be lightweight and flat enough to hang on the wall. The LCD models currently offered are the hand-held small 2" models. Companies are trying to develop 9 to 13" LCD TVs. The LCD TV has some technical problems to overcome such as: 1) LCDs do not generate light but only reflect available light; 2) LCDs do not produce the dark black and the luminous whites that current TVs offer; and 3) LCDs respond slowly to rapid changes in the picture which results in smears in the screen during these rapid movements.

Multichannel Television Sound (MTS) for Television. Stereo TV began with simulcasting in which FM radio stations carried simultaneous stereo audio tracks for television programs. In 1979, PBS's Great Performance series was the first stereo simulcast. In March 1984, the FCC allowed stereo programming and broadcasting. NBC became the first network to broadcast in stereo -- the Tonight Show. NBC is broadcasting 29 hours weekly, the majority of its 1987 new prime time schedule, in stereo. Stereo sound television receivers sold to dealers from the beginning of 1987 to July 24, 1987 totalled 1.76 million, up by 25.5 percent from the 1.4 million in same period in 1986. Currently, 7 percent of U.S. TV households have multichannel sound TVs. EIA projects receiver penetration of stereo capability will increase with 37 percent of all TV sets and 22 percent of all VCRs sold to dealers. In 1988, stereo TVs will represent 43 percent of color sets sold and 24 percent of VCRs will have stereo, according to EIA. Also EIA projects that 400 stations will be broadcasting in stereo

---

by the end of the year.[61] Those TV sets without stereo capability can be modified to receive stereo broadcast by using devices that obtain the stereo sound information and send them to your speakers.

Picture Tube Enhancements. Zenith believes that it has designed a technological breakthrough: a revolutionary new picture tube with a flat front that provides picture quality far superior to that of even the best traditional picture tubes, without much difference in price. The screens have a perfectly flat face and Zenith claims that this all but eliminates glare and dramatically improves contrast and picture quality.[62]

iii) **Video Systems.** Since the video cassette recorder (VCR) was introduced in the U.S. market in 1975, its sales growth has outpaced color television. VCRs are common additions to the home -- an estimated 40 percent of U.S. households have a VCR and by the end of 1987, VCR penetration was over 50 percent. Most VCRs now use either Beta, VHS, or a more recent standard, the 8mm video format. With such a high household penetration rate and after such rapid growth, VCRs sales have seemed to reach a peak with only 3.8 percent growth in the number of units sold for 1987.[63]

In 1987, the majority of manufacturers decided to only produce VCRs in the VHS standard. Only 16 percent of U.S. households have Beta VCRs and only 10 percent of new VCRs play Beta.[64] The Beta VCR owner should note the impact of this decision. On January 10, 1988, Sony -- developer of the Beta standard -- announced that it will begin to offer VHS VCRs later in the year. Sony's Chairman Akio Morita had stated in the past that the company would never produce a VCR with a VHS standard.[65] Sony will continue to offer Beta VCRs and especially target those videophiles searching for higher quality picture and audio. Sony's decision to offer VHS recorders seemed inevitable. In 1981, Sony's share of the Japanese VCR market was 40 percent and by 1987, the company's share declined to 7 percent.[66]

How will this affect the Beta VCR owners? For the short term, Beta owners who purchase cassettes will benefit at the video rental stores outlets since these stores will be offering discount prices to clear their Beta stock. In the long term, the Beta owner will notice a lack of available new software -- new movies in Beta -- because cassette distributors will decide not to produce Beta cassettes for a small market. RCA/Columbia and HBO Video have decided to only release the most popular movies on Beta format. In Washington D.C., a popular video club chain has announced that new rental stores will only offer VHS cassettes.[67]

New standards for the VCR are being developed and marketed in certain countries. Super VHS, for example, is one new standard offered in Japan by JVC, Sharp, Mitsubishi, Matushita and Hitachi. Super VHS (S-VHS) will offer significant picture improvement on existing TV sets, but for maximum benefit, a special monitor is required to receive the luminance and chrominance signals through a special connector called an "S-video" input. The S-VHS offers higher bandwidth or more information to the picture tube. At the Summer 1987 consumer electronics show, only a few offered S-video inputs on their newest television sets. S-VHS recordings are made on a new tape format and will not play on regular VHS decks. However, S-VHS machines include a switch that enables them to record in regular VHS mode and will play existing VHS recordings as well. 3M is offering S-VHS tape and other companies such as TDK, Fuji, Maxell and GE had announced plans to market S-VHS tape.

Another VCR standard was also introduced at the summer consumer electronics show. Sony demonstrated its own version of an enhanced VCR called "ED-Beta" (for extended definition). At the show, Sony announced its intention to export ED-Beta to the U.S. sometime next year, but that decision may change depending on what happens with S-VHS. When Sony announced plans to offer VHS VCRs, the company stated that it had no plans to offer the S-VHS recorders.[68]

A portable TV monitor/VCR was displayed by Casio at the 1987 Winter Consumer Electronics Show. The unit displayed had a 3.3 inch color monitor and used standard VHS tapes. Casio was expected to offer this product by April 1988 for approximately $1,400. Marketing of this product will stress the educational, and commercial uses for this product. While on a business trip or commuting to and from work, the owner could watch an instructional tape. With such a portable unit, the VCR may enter some uncommon environments. Mechanics could store libraries of cassettes (from the car manufacturers) to offer assistance in complex situations.[69]

Camcorders, the one-piece camera-recorder, are quickly replacing the two piece portable recording systems. The camcorder enables the owner to film almost anywhere and then return home, connect the unit to the TV , and playback the recording. For filming, camcorders offer such features as power zoom, automatic focus and brightening. Camcorders are available in VHS, Beta, and 8mm format and in the near future in the S-VHS format. Most camcorders are being purchased by owners that already have VCR table models, but as more consumers become aware of camcorders' dual role this trend might change.

iv) Audio. Technological advancements in audio continue with the introduction of the Digital Audio Tape (DAT) player/recorder and the compact disc.

The DAT device uses a small cassette similar in design to a Beta, VHS or 8mm video cassette and uses a digital playback system similar to the CD. While the DAT provides the owner with information on tracks and elapsed time in subcodes as does the CD, it also uses a new digital sampling rate for recording. The standard length of the DAT tape will be two hours of uninterrupted play on the tape's one usable side. The DAT is incompatible with any current audio tape form. The first DATs are similar in looks to a CD player and rather heavy -- 26 pounds -- to allow for two separate power supplies needed for analog and digital circuits, and will also have more address coding buttons than the CDs, as well as recording capabilities.[70]

At the 1987 Internationale Funkausstellund Audio Video Fair in Germany, DAT devices were exhibited by Sony, JVC, Casio, Grundig, Hitachi, Panasonic, Pioneer, Sanyo, Sansui, and Blaupunkt (car players). DATs became available in Japan in March 1987 for as low as $1,650 and Sony plans to market a DAT recorder ($1,934) in Europe in October. Sony plans to sell 10,000 units in Europe in the first year.[71] The future for DATs seems very promising -- in Japan, the first year sales of DAT recorders were 30,000 and the first year sales of CD players were 27,000.[72] Sony is offering to supply DAT players to Ford as an option for its 1988 Lincoln Continental.

However, the DAT device is experiencing a problem -- it may record too well. Record makers state that DAT will confuse consumers and hurt the new CD market; more importantly, DAT will allow for high quality reproduction. Representatives from music industry associations from 20 countries have opposed the sale of DAT hardware that is not equipped with the CBS-developed copy-code scanning system. The copy-code scanning system would not allow the DAT to record digitally from 44.1 KHz digital sources which are CDs and commercial DAT releases. Also five recording manufacturers -- CBS, Warner Brothers, EMI, Polygram and RCA -- also support the copy-code scanning system and will not provide the market with DAT prerecorded software unless the system is required in the DAT hardware.[73]

There has been some indication that Japanese and European manufacturers may propose an alternative anticopy system for the DAT. The system would allow direct digital recording at 44.1 KHz sampling frequency, but the system would place a code in the copy which would prevent it from being used to make other copies.[74]

In the United States, the House Commerce, Consumer Protection, and Competitiveness Subcommittee approved a bill (H.R. 1384) that would temporarily block, for three years, DAT recorders unless an encoding device is placed in the DAT which will prevent the taping of CDs. The Electronic Industries Association and the Home Rights Recording Coalition were expected to challenge the constitutionality of the legislation on the grounds that Congress has prohibited the sale of other consumer products only for health or safety reasons. Marantz announced that it was not going to wait for Congress or anyone else and planned to sell DAT here in early fall.[75] However, the sponsors of the bill have withdrawn the legislation after tests were completed by the National Bureau of Standards (NBS). NBS tested the CBS copy-code system and detected effects which impaired the sound quality. NBS received assistance from High Fidelity's technical editor, Mr. Ranada, when he found the "killer chord" in Serge Prokofiev's "Alexander Nevsky" that was affected by the CBS copy-code system. Currently, the DAT recorder has started to appear in very specialized audio stores in the United States.[76]

The compact disc player entered the marketplace in 1983 and allows consumers to significantly improve their sound systems. Compact disc players can be purchased for as little as $150. The disc are 4 3/4", made of a tough polycarbonate plastic (material used in making airplane windows) which resists warping up to 220 F and can hold up to 74 minutes of music. The CD player uses digital technology. The disc consists of digits that take the physical form of tiny bumps coated with reflective metal and clear protective plastic. The player's laser or lasers, depending on the model, scans the surface and notes the transition from a flat surface to a bump and so on. This information is translated into "1" and "0"s, called bits, and the bit information translates into the sound you hear. The storage capacity of a compact disc is extremely large. Each second of music is composed of 88,200 separate measurements, each of which can range on a scale from zero to 65,535; the CD can hold 270,000 pages -- a complete encyclopedia.[77]

The availability of discs has increased sharply, but disc prices have not yet fallen as much as was hoped. While manufacturing costs are beginning to drop, many popular artists who earlier had agreed to modest royalties in order to help the new format take off are asking for a bigger share now that the CD market exists.[78] In May 1986, there existed seven or eight major CD pressing plants in the world. By June 1987, the number of disc manufacturing facilities reached 17, with at least eight located in the U.S. and Canada.[79] With lower prices anticipated, the incentive for households to obtain a CD should increase. It is estimated that only 3 to 5 percent of U.S. households currently have a CD player.[80] Also, CDs are increasingly being combined with other equipment. At the Summer Consumer Electronics Show for example, Sharp introduced a $900 combined CD and 100 watt receiver while Bang & Olusfen introduced a $2,995 CD player/receiver/cassette deck.

The uses for compact discs will grow as technological advancements continue. While the consumer is becoming familiar with the 12 cm music disc, other discs are entering the market which will impact the consumer and business markets. A CD which offers both full motion video and music, called CD-V, is soon coming into the market. With the 12 cm standard size of the CD, the storage limitation allows for only five minutes of video program length. Philips in mid-February, convinced its CD partner Sony to jointly announce the launch of CD-Video strategy in world markets. CD-Vs would be priced around $6.50 and be produced for music videos, clips, and short-feature films. Other CDs will be compatible with the Laservision Video discs (which failed commercially in Europe and developed a small market in the U.S. and Japan) and offer both music and video. An eight inch disc is called a CD-V EP and a twelve inch disc is referred to as a CD-V LP. Combination players (beginning at $800) will play the 12 cm CD and the CD-V, CD-V EP, and CD-V LP. Magnavox, Toshiba, Denon, Yamaha, Sony and Pioneer introduced these players at the summer consumer electronics show.[81] With CD technology offering digital audio and video, a new generation of laservision video players might introduce a serious competitor to the video-tape. A Frost & Sullivan study predicts that video disc players will become more popular for non-consumer industrial, government and professional and commercial markets. The study, the "The Non-Consumer Market for Videodisc Technology", reports that sales of non-consumer videodisc programs will rise an estimated $140 million in 1987 to $605.56 million by 1991, and the hardware will increase from $209.25 million in 1987 to $453.06 million in 1991.[82]

For storage of data, one CD-ROM (Read-Only-Memory) is capable of holding the same amount of data as 1500 floppy discs. The entire home encyclopedia Britannica can fit on one 12 cm disc. At first glance, the CD-ROM would seem less attractive as the price of hard disks for computers continues to drop, but the ease of mass-producing these CDs inexpensively is an advantage. CD-ROMs are ideal for the storage of bibliographic information, reference works, legal citations and large financial data bases. CD-ROM disk drives which connect to a computer are available for about $1000 to $2000. IBM introduced a CD-ROM disk drive as an option to PS/2 computers.[83]

Another form of CD, called CD-I (Interactive) provides not only data, but pictures and sound as well. CD-I was developed to offer interactive programs for consumers with discs intended to sell for $15 to $60 depending upon the software. CD-I programs are being developed for interactive travel guides, music almanacs, mystery stories, games, learning and educational and informational projects. Delay in the introduction of CD-I is not because of technological limitations, but rather due to developing standards for the CD-I format.[84] In the developmental stage is the CD-DVI (Digital Video Interactive) which offers 60 to 72 minutes of full motion video, and 12 cm CD-ROM storage.

v) **Home Computers**. As prices have declined, the computer has become a familiar item not only in the office but many households as well. By 1988, an estimated 37.5 million personal computers will be in use: nearly one for every six U.S. residents.[85] The home computers are becoming more sophisticated as prices drop for peripheral equipment. At first computers were for home entertainment, but now these computers are having an integral role in some homes by being an important component for financial planning, research, screening calls and home security. The household computer can offer more by accessing information over the phone through the use of a modem. Over 4.4 million personal computers in the U.S. today have communications modems that allow access to information services, and this number is expected to grow to 13.1 million by 1992.[86]

vi) **Commercial Applications of Consumer Electronics**. Many consumer electronics products and the technology developed for these products are being used for commercial and educational purposes.

Although not available to viewers, HDTV has been used to produce a commercial in France, a show in Canada, and films in Italy and the United States. HDTV allows producers to use a technique called blue screen matting for special effects. This process allows the producer to lay one scene onto another and, with HDTV, this process is undetectable to the viewer. High resolution television is also being used for certain test simulators.

Although the compact disc video player was not received enthusiastically in the U.S. consumer market, the laser technology used allows for large amounts of information to be accessed quickly. These players are being used by the U.S. Army for training and repair classes. Once a standard and more software are developed for CD-I, this technology will offer interactive capabilities with both audio and video information. The CD-I discs are expected to sell for $15 to $60 and software is being developed for interactive travel guides, educational and informational projects.

In April 1988, Casio introduced a portable TV monitor/VCR. The unit display will have a 3.3 inch color monitor and use standard VHS tapes. If you have a long commute to work, this portable VCR can offer you two hours of programming -- educational or entertainment. Such a small playback system might also be practical for repair persons to assist them in completing complex and/or uncommon tasks. The VCR as an educational tool will expand with the availability of VCR/TV monitor units.

As more of the population continues to become more computer literate, interactive programs will become more advanced and affordable. Advanced interactive programs will seem very close to artificial intelligence and the possible offerings seem endless. Certain programs might be useful in teaching certain languages. Another program may assist a frustrated writer in stimulating his or her imagination.

Currently, the personal computer has begun to blurr the division between the household and the office. Many people prefer being close to home and do not mind missing the day-to-day office environment. With a modem, the PC at home can access the home office and hundreds of other information sources. The increasing availability of the telephone facsimile is allowing even more flexibility in the work place.

Major Trends and Issues

Many new consumer electronic products are often noted for improvements that are referred to as revolutionary. Most of these products stress improved quality, (e.g. higher resolution picture, near perfect sound reproduction) and the reason for these revolutionary improvements is the digital technology being used. The compact disc player, digital television, digital audio tape recorder, and the super VHS format suppliers claim that digital technology provides a quality that is substantially better than that of the current turntable, color television, tape player and VCR. Table IV shows the estimated percent of households that have certain consumer electronics products.

Until very recently, television and audio components relied upon analog technology. When a person speaks, his voice becomes a continuous analog waveform created by fluctuating air pressure. For a phone conversation, the waveform created by the voice is recreated into an electrical form and once it reaches the other telephone, the signal is recreated into a waveform of sound. Digital technology recreates the sound of music by sampling the sound at an extremely fast rate and encodes the sound into "0" and "1". Through sampling, the "O" and "1" identifies fluctuations in the waveform. This conversion from analog to digital signal is called encoding. To play back the sound or the picture, the digital signal is decoded back to an analog waveform. When the DAT and the Super-VHS VCR are copying a signal, the equipment encodes the signal to digital information. The CD player obtains digital information from the compact disc which is a reproduction of the master disc created by encoding the music's analog signal into a digital format.

The analog to digital to analog conversion recreates the original sound and is superior to the analog to electronic analog to analog conversion. A simple test of the advantages of digital technology is to listen to your favorite music on turntable and then a CD player. The CD offers a dynamic range of sound and the background noise caused by the contact of the stylus to the record is removed.

Even with digital consumer electronics, the consumer's household still receives audio and video information over analog signals. By the year 2000, however, the household may have fiber optic lines entering the household to carry digital information - audio and video. Such cables carry information using light transmitted over glass fibers and would offer the household tremendous capabilities. With such technological advances, new services could reach the consumer such as videophone service, video monitoring of the children or home while at work, sophisticated home security systems, and remote environmental control systems.

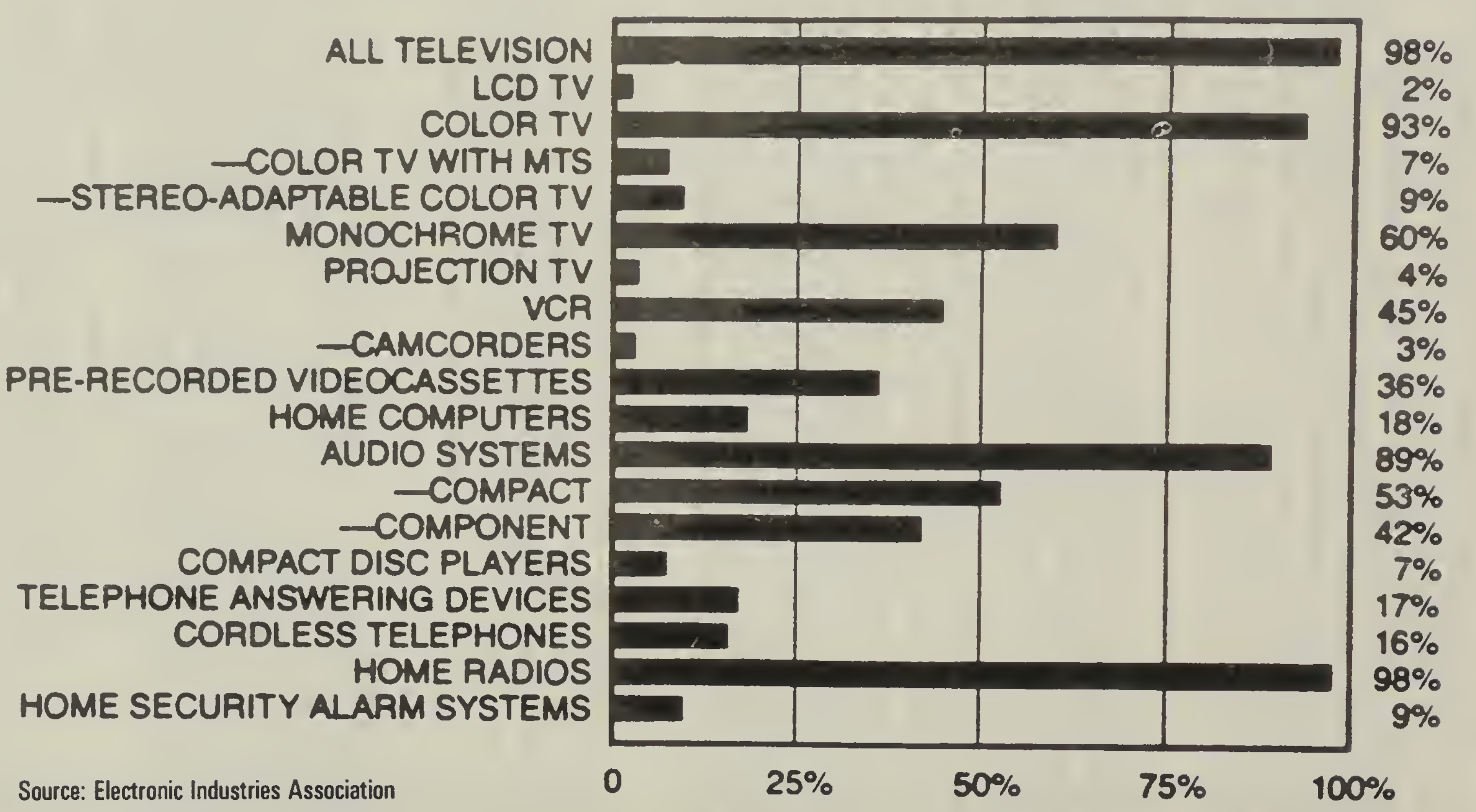
Digital technology is bringing about the "smart" office and "smart" home. The smart home will rely upon the phone and power line to act as the conduit for streams of information necessary to manage the household. The Electronics Industries Association is currently developing industry-wide standards to let intelligent homes become a reality. The personal and business applications available within an intelligent home will be limitless, and may radically change our current lifestyles.[87]

Short Term Growth: The consumer electronics sector is expected to experience 3 to 4 percent growth in the coming years. Such growth is small for an industry that has quadrupled in market size over the past ten years. Several reasons have been cited for the conservative projections. Consumer electronics products are sensitive to a variety of changes including price changes. A two-year decline in the value of the dollar has resulted in companies announcing slight price increases of 2 to 7 percent for VCRs and television sets. The value of the dollar in comparison with the yen has dropped from 230 yen two years ago to approximately 130 in January 1988.[88] However, this appreciation of the yen has led to declines in Japanese exports, elevated the production at offshore facilities, and provided some incentive for Japanese manufacturers to consider expanding their offshore facilities.

TABLE 4

ESTIMATED HOUSEHOLD PENETRATION BY PRODUCT

(As of June 1987)



Source: Electronic Industries Association

Another reason for justifying conservative growth figures is the absence of a known revolutionary consumer electronics product to continue the significant growth resulting from sales of VCRs. The personal computer, the facsimile phone, and the DAT recorder are products which will provide steady growth for next few years. However, the introduction of the DAT to the United States has been delayed due to intellectual property concerns.

Of course, the characteristics of the consumer are vital in marketing any product including consumer electronics. The consumer's age, amount of disposable income, and socio-economic status might indirectly affect the growth rate of consumer electronics. In the next few years, the consumer electronics market will experience some growth, but will not experience the significant growth of the past decade.

Long Term Growth. U.S.-based manufacturing of consumer electronics quickly disappeared as Japanese and other Asian companies became the leading suppliers of consumer electronics to the United States. As an example, approximately 3.4 millions CD players were imported to the United States, and over 96 percent of those imports were from Japanese manufacturers. The growth of the semiconductor industry in Japan and other Asian countries enhanced their ability to develop state of the art consumer electronics. Western Europe has been able to limit the role these manufacturers have in their markets.

With the General Electric Company's sale of its consumer electronics division to France's government owned Thomson Group, Zenith became the only major U.S.-owned television manufacturer. Currently, Zenith is successful in selling its personal computers while its television division has contributed to third quarter losses of over $25 million.[illegible] Some investors have recommended to Zenith's Chairman Jerry Pearlman that he sell the company's television division. In August, Mr. Pearlman announced that Zenith is considering a number of options with regard to its consumer electronics including possible joint ventures, and divestiture.

Zenith had more discouraging news in 1987. A legal suit filed 16 years ago by Zenith and National Union Electric Corporation against Japanese television manufacturers was dropped after the Supreme Court refused to review the case. The Supreme Court dismissed the suit due to insufficient evidence to indicate a predatory pricing conspiracy by the Japanese television manufacturers.[illegible]

The United States must seriously consider if it can once again become a leading manufacturer of television sets and other consumer electronics equipment. A delegation, led by the National Association of Broadcasters (NAB), went to Japan to discuss HDTV developments. The delegation reported that Japan is well along in preparing for the production of HDTV sets. The Japanese plan to introduce HDTV on a large scale by 1990 with the launching of their broadcast satellite. The Ministry of Posts and Telecommunications has established an office to promote the new technology, and part of the HDTV promotion is their plan to film the Seoul Olympics in HDTV format. The NAB delegation stated that the U.S. would have extreme difficulty in recapturing the television market since the Japanese have been preparing for HDTV for the past 20 years. The delegation recommended that U.S. manufacturers' should focus their efforts on developing complimentary equipment to be used in the filming and editing of HDTV programs.

If Japanese companies begin mass production of HDTV sets by 1990, it would seem rather unlikely that U.S.-owned manufacturers can become leading suppliers of consumer electronics within the next two years. The consumer electronics market is extremely competitive, and new suppliers would have extreme difficulty entering the market. With the introduction of HDTV in the very near future, the United States must determine if it can once again become competitive in this sector, and the United States must continue to encourage overseas consumer electronics companies to locate manufacturing facilities in the United States.

Notes

1. 1987 U.S. Industrial Outlook, U.S. Department of Commerce, p. 44-9

2. Ibid., pp. 44-9 - 44-10.

3. 1988 Electronic Market Data Book, Electronic Industry Association (EIA), (Washington, D.C.), p. 6.

4. Consumer Electronics U.S. Sales, EIA, June 1987, pp. 1-2.

5. 1988 Electronic Market Data Book, p. 6

6. 1987 U.S. Industrial Outlook, U.S. Department of Commerce, p. 44-9.

7. Ibid.

8. Audio Video International, June 1987, p. 14.

9. Communications Daily August 14, 1987, p. 5.

10. Washington Post Magazine, "Technical Aid for the TV Set," April 26, 1987.

11. 1987 Electronic Market Data Book, Electronic Industries Association, p. 10.

12. Consumer Electronics U.S. Sales, June 1987, p. 2.

13. 1988 Electronic Market Data Book, p. 6.

14. Ibid., p. 18.

15. Communications Daily, August 7, 1987, p. 8.

16. 1987 U.S. Industrial Outlook, p. 44-10.

17. 1988 U.S. Industrial Outlook, p. 47-7.

18. "Overnight Thomson Has the Stuff to Take on the Titans," Business Week, August 10, 1987, p. 36.

19. 1987 Electronic Market Data Book, p. 18.

20. Audio Video International, June 1987, p. 14.

21. 1987 Electronic Market Data Book, p. 24.

22. AM Stereo and the Future of AM Radio, NTIA Report, February 1987, p. 13.

23. 1987 Electronic Market Data Book, p. 22.

24. 1988 Electronic Market Data Book, p. 22.

25. Consumer Electronics U.S. Sales, June 1987, p. 10.

26. Audio Video International, June 1987, p. 40.

27. Consumer Electronics U.S. Sales, June 1987, p. 12.

28. Consumer Electronics U.S. Sales, June 1987, p. 14.

29. 1988 Electronic Market Data Book, p. 26.

30. Ibid.

31. Consumer Electronics U.S. Sales, June 1987, p. 14.

32. Resurgence in Home Information Market Led by Strong Computer, Telephone Sales, EIA, March 27, 1987.

33. Ibid.

34. "Sales Frenzy Hits Personal Computers," USA Today, August 17, 1987, p. A-1.

35. Cox, Maurice A., Executive Vice President, CompuServe, Inc., Testimony before the House Subcommittee on Telecommunications and Finance, August 30, 1987.

36. 1987 Electronic Market Data Book, p. 48.

37. 47 C.F.R. 73.593 (1982) . In 1983, the FCC extended subsidiary communications uses of FM subchannels. First Report and Order, BC Docket 82-536, FCC 83-154, adopted April 7, 1983, 53 R.R. 2d 1519 (1983) .

38. 47 C.F.R. 73.242 (1983) .

39. FM Stereo Multiplexing Decision, 21 R.R. 1605 (1962).

40. TV Cable Factbook No. 52, Television Digest, 1984, p. 7.

41. Report and Order, Docket 21313 (FCC 82-111), adopted March 4, 1982, 47 Fed. Reg. 13152 (March 29, 1982).

42. AM Stereo and the Future of AM Radio, NTIA Report, February 1987.

43. Comments of the United States Department of Justice, "Petition for Inquiry into the Need for Adequate Television Service for the State of New Jersey," Docket No. 20350, RM-2345, p. 4.

44. Sixth Report and Order on Television Allocations, 41 F.C.C. 148 (1952).

45. 1962 All Channel Receiver Act, Pub. L. 87-529, 76 Stat. 150 (1962).

46. 47 C.F.R. 15.66, 15.68 (1983).

47. See also Adoption of NTSC Standard, 10 R.R. 1501 (1953).

48. TV and Cable Factbook, No. 52 (1984), p. 19.

49. U.S. Industrial Outlook 1988, p. 47-5.

50. U.S. Industrial Outlook 1986, p. 45-9.

51. U.S. Industrial Outlook 1988, p. 47-8.

52. Ibid., p. 47-7.

53. Business Week, August 10, 1987, pp. 36-37.

54. Ibid.

55. Communications Daily, "Zenith Explores 'Range of Options' for Consumer Electronics Operation," August 5, 1988, p. 5.

56. U.S. Industrial Outlook 1988, p. 47-6.

57. Notice of Inquiry, Docket No. RM-8511, adopted July 16, 1987.

58. "Picture Perfect? Next Generation of TVs Promises Breakthrough in Image Quality," Wall Street Journal, August 24, 1987, p. 25.

59. Audio Video International, June 1987, p. 14.

60. 1987 Electronic Market Data Book, p. 16.

61. Broadcasting Magazine, August 10, 1987, p. 15.

62. "Zenith Survives TV Wars: Firm Looks to Computers, Flat Screens for Future," Washington Post, August 23, 1987.

63. New York Times, January 11, 1988, p. D-1.

64. "The Spreading Beta Blackout," Washington Post, p. C-7.

65. Communications Daily, January 12, 1988, p. 4.

66. Financial Times, January 12, 1987, p. 22.

67. Ibid.

68. Wall Street Journal, January 13, 1988, p. 39.

69. New York Times, January 12, 1988, p. F-15.

70. Audio Video International, June 1987, p. 26.

71. Wall Street Journal, August 31, 1987, p. 5.

72. Communications Daily, September 2, 1987, pp. 6-7.

73. Audio Video International, June 1987, p. 14.

74. Communications Daily, December 29, 1987, p. 3.

75. "Pieces of 88: Exciting Finds from the Summer Consumer Electronics Show," High Fidelity, September 1987, p. 45.

76. Fantel, Hans, "Sound. Breaking the DAT Barrier," New York Times, August 7, 1988, Section 2, p 26.

77. Digital Features, Digital Futures: Behind the Revolution in Consumer Electronics, EIA, July 20, 1987.

78. High Fidelity, September 1987, p. 45.

79. The cost of a CD pressing facility ranges anywhere from $10 to $60 million, depending on the size and location of the plant

80. Audio Video International, June 1987, p. 40.

81. High Fidelity, September 1987, p. 53.

82. "Videodisk Technology: Non-Consumer Market Promise Steady Growth, with Possible Explosions," Frost and Sullivan, Inc.

83. "Compact Discs are Moving into PCs: Technology Makes It Easier to Store Large Amounts of Information," Washington Post, Business Section, p. 15.

84. Audio Video International, June 1987, p. 43.

85. "Sales Frenzy Hits Personal Computers," USA Today, August 17, 1987, p. A-1.

86. Cox, Maurice A., Executive Vice President, CompuServe, Inc., Testimony before the House Subcommittee on Telecommunications and Finance, August 30, 1987.

87. "High I.Q. Homes on the Horizon," EIA, March 27, 1987.

88. "Is the Fall in Video Prices Ending?" New York Times, p. D1.

89. USA Today, December 10, 1987, p. B-1.

90. U.S. Industrial Outlook 1988, p. 47-6.

XVII Communications And Information In Rural America

by Allison Deeb
John Dern

The provision of high quality and reasonably priced telecommunications services to rural America[1] has long been recognized as a major goal on the part of both state and federal policymakers. During the earlier part of this century, telephone service in rural America was less developed than telephone service in urban areas. Much of this was due in part to the inherent nature of rural areas compared to urban areas -- smaller total population,[2] larger geographical distances and barriers between points, and a lower population density. These characteristics have a direct bearing on both the cost and types of telecommunications services available to various rural communities. However, over the past forty years government initiatives and incentives, as well as policy decisions promoting marketplace innovation and competitiveness have facilitated the growth and development of the rural telecommunications infrastructure as it exists today.

Historically, the actual costs of rural telecommunications services have been higher and the quality lower relative to urban areas. Regulation and subsidy were used extensively to bring prices below costs so that certain policy objectives could be achieved. These included the concept that affordable, high quality telephone service is important not only to rural citizens but also to the nation as a whole because of the underlying strength provided by a unified, integrated telecommunications system. Various laws, policies, and regulations have been enacted to make universal service a reality including amendments to the Rural Electrification Act to support the expansion of telephone service to rural areas,[3] the development of separations and settlements[4], and the establishment of rate averaging.[5]

In the future, however, promising future technologies suggest that some of these cost and quality constraints can be broken and that in some areas the role of regulation and subsidy can be reduced or possibly eliminated. In the provision of video programming and broadcast services, a number of technological advancements using satellite communications and digital radio already have changed this market and have presented rural residents with an array of new viewing options. The development of modern telecommunications technologies including higher power satellites, advanced terrestrial radio communications, fiber optics, and Integrated Services Digital Networks (ISDN) similarly may pose a number of fascinating options for policymakers and rural residents alike to apply to rural telecommunications needs.

This report examines the historical and technological issues pertaining to the development of the telecommunications infrastructure in rural America. It presents various historical as well as technological developments affecting the development of the rural network infrastructure, and it introduces the major organizations as well as policy initiatives and their role in the early and current expansion of telecommunications services in rural areas. Finally, through the discussion of the various issues outlined above, a foundation is built for analysis and extrapolation regarding future policy directives.

Historical Perspective

Government involvement over the past years has contributed to the growth and maintenance of telephone service in rural areas. The major impetus behind the establishment of the initial telecommunications network can be traced back to the Rural Electrification Act of 1936 and the later amendments supporting the development and expansion of rural telephone service. In addition to the Act, the NTIA, FCC, and Congress, through various public policies, incentives and programs have facilitated the development of the telecommunications industry in rural areas.

The Rural Electrification Administration (REA) has become the primary government agency concerned with both electricity and telecommunications development in rural America.[6] The Act mandated federal support for the electrification of rural America because existing utility companies served only high density areas which were more economically feasible to serve than the rural areas. As telephone service developed in urban areas, it became clear that federal support was necessary to promote the development of adequate and dependable telephone facilities so that basic telephone service would become available on a widespread basis in rural areas. Thus, efforts to expand the role of REA and to foster the growth of telephone service were initiated.

By 1949, the REA had grown in its financial role of assisting rural telephone organizations and was authorized to loan funds for telephone service in rural areas. In 1971, the Rural Electrification Act was amended further to establish a Rural Telephone Account (RTA) and the Rural Telephone Bank (RTB) which have been the primary source of financing for rural telephone service providers over the past twenty-five years.[7] The cumulative total of REA loans to telephone borrowers as of Sept. 30, 1987 was $5.3 billion.[8] For FY 1987 REA loans to telephone borrowers across the nation amounted to $229,787,000.[9] Table 1 shows the increasing percentage of telephone penetration on farms across the United States. Table 2 shows the increase of one party service over the early more traditional four and eight-party service. Now almost 98 percent of rural America has access to basic telephone service. Governmental telephone initiatives spurred the growth of basic telephone

TABLE 1
Percent of Farms With Telephone Service[10]

Year	Telephone Penetration
1950	38.0
1955	50.0
1960	67.0
1965	77.0
1970	84.0
1975	90.0
1980	94.0
1985	96.0
1986	96.0
1987	96.0

TABLE 2
Rural Party Line Development[11]

Service	1986 Survey	1969 Survey
One-Party	91.4%	39.9%
Two-Party	2.1%	10.6%
Four-Party	6.3%	22.0%
Over Four-Party	0.2%	27.5%

service in areas that were undeveloped or unserved due to market failure. Moreover, results from the 1986 REA Subscriber Loop Study show that rural subscriber loop facilities furnished by REA-financed telephone companies are comparable in quality to similar urban facilities. Table 3 shows the current composition of rural subscriber loop plant.

As shown in the table, rural telephone companies have made considerable progress in the installation of higher quality subscriber loop plant equipment. Buried filled copper paired cable now represents almost 40 percent of all plant equipment. The introduction of fiber optic cable into the local loop is small but growing. Finally, open wire plant has been virtually eliminated. The weakest link in the rural subscriber loop is the buried nonfilled cable which is unsuitable for higher frequency applications such as data transmission or Integrated Services Digital Networks (ISDN). This represents almost 25 percent of all loop plant.[12]

Despite the exponential growth in the 1960's and 1970's, however, government support of the REA and the telephone loan program has been questioned due to the plateau effect of telephone service penetration in the past decade.[13] Some legislators and regulators believe that since REA's original purpose -- to bring basic telephone service to rural America -- is essentially fulfilled, the mission of the REA is completed. Recently, a bill was introduced in Congress to reform the current REA loan program.[14] The proposed legislation would ensure that eligible borrowers get direct assistance and would replace high-subsidy REA direct loans with loan guarantees for legitimate rural loan recipients. Further, the REA proposed in August 1988 to consolidate, revise and clarify the policies and procedures required by various REA publications pertaining to telephone materials, equipment, and constructions, and to the advancement and disbursement of REA loan funds for the planning and construction of telephone and telephone-related facilities. As legislative reform and debate continues, it appears that the future role of REA may be scrutinized and the telephone loan program redefined.

The Public Facilities Telecommunications Program (PFTP) administered by NTIA, is another program incentive facilitating the development of telecommunications. PFTP provides grants to assist in the planning and construction of public telecommunications facilities. Special emphasis is placed on extending public broadcasting signals to currently unserved areas.[15] Since 1962, more than 2100 facilities grants have been administered, activating more than 500 new public TV and radio stations and upgrading another 1300 facilities. The PFTP has been instrumental in extending U.S. public radio coverage to nearly 80 percent of the population and public TV coverage to almost 95 percent of the population.[16]

In the past decade, the Federal Communications Commission (FCC) has provided assistance to small rural telephone companies by reducing various regulatory procedures and requirements. On May 14, 1987, the FCC adopted rules allowing small telephone companies to avoid all direct access tariff filing burdens and to participate in revenue pools administered by the National Exchange Carriers Association (NECA)[17] Further, the FCC, on January 1, 1988 adopted rules which established a new rural radio service (RRS) known as the Basic Exchange Telecommunications Radio Service (BETRS) to allow local exchange carriers the flexibility to use radio, rather than wire, to provide local telecommunications service in rural households and businesses.[18] BETRS, for some rural communities, is more cost-effective than installing cable wires over rough, hilly terrain.[19]

Further FCC initiatives to encourage telecommunications technology development in rural America include the "Link Up America" Service program[20] and the Universal Service Fund.[21] In addition to the efforts of the Rural Electrification Administration, NTIA, and the FCC, various trade associations affiliated with rural economic development and small telephone companies have played an influential role in the development of rural telecommunications.[22]

Equal Access and Competition in Rural America

In the past five years, joint business ventures which promote both universal service and intersate equal access have occurred in some rural service areas (RSA's).[23] The Indiana Switch proposal, a joint venture between U.S. Switch, Inc. and 27 other independent telephone companies in the state of Indiana, was the first to attempt to promote equal access and bring competition in the interstate access market to rural America. By aggregating the traffic at a centralized tandem switch, Indiana Switch proposed to provide equal access to all long distance carriers. Despite its original intent, the project appears to have stalled apparently due to financially-related difficulties.

TABLE 3

		Percent of Plant	
Plant Type	Cable & Wire Type	1969 (%)	1986 (%)
Buried	Filled Copper Pairs	0.0	39.9
Aerial	Filled Copper Pairs	0.0	2.3
Underground	Filled Copper Pairs	0.0	0.9
	Subtotal	0.0	43.1
Buried	Nonfilled Copper Pairs	30.4	24.3
Aerial	Nonfilled Copper Pairs	32.6	26.2
Underground	Nonfilled Copper Pairs	1.9	2.6
	Subtotal	64.9	53.1
Buried	Fiber Optic	0.0	0.3
Aerial	Fiber Optic	0.0	1.0
	Subtotal	0.0	1.3
Buried	Distribution Wire	2.5	1.1
Aerial	Distribution Wire	7.0	0.2
	Subtotal	9.5	1.3
Buried	Service Wire	0.6	0.6
Aerial	Drop Wire	2.0	0.3
	Subtotal	2.6	0.9
Aerial	Open Wire	22.9	0.1
Total		99.9	99.8

Composition of Rural Subscriber Loop Plant[24]

Additional projects modeled after the Indiana Switch venture were initiated in Illinois, Iowa, North Carolina, and Wisconsin.[25] For example, Iowa Network Services (INS) expects to be operational by mid-1989.[26] INS, although similar in scope to Indiana Switch, is structured somewhat differently. The organization is comprised of two separate divisions -- an Access Division and a Network Interexchange Carrier Division. The Access Division will become a carrier and operate the transmission facilities. The Interexchange Carrier Division will construct the switch, own the network, and lease them to the Access Division. The digital switch, centered in Des Moines, will receive all toll traffic hauled via an 865-mile fiber optic network installed across the state and will link all sixteen toll centers throughout the state. Like the Indiana Switch model, traffic will be aggregated at an access tandem switch. The 130 companies participating in INS serve more than 158,000 subscribers in about 300 exchanges.[27] When the independent telephone companies combine their interstate traffic in one location, it is more economically advantageous for them to provide equal access to long distance service providers which will serve the rural communities. The aggregation of traffic of small independent telephone companies thus facilitates universal service, and seems to be one measure on the behalf of rural telephone companies to increase long distance competition in rural markets in the United States. The continuance of statewide networks like the Iowa project may foster the development of new products and services. Hence, benefits of increased competition may become a reality for consumers in rural areas.

The Television Receive Only (TVRO) Market

Few areas have been as conspicuous and turbulent in their development in the telecommunications marketplace as the home satellite market. Satellite delivery of domestic video programming began in 1975 when Home Box Office began distributing its programs to cable systems that were required to obtain licenses granted by the FCC to build private earth stations. Soon individuals found that as more programmers and distributors followed HBO's lead, a satellite dish might be a good investment, particularly if television reception in the area was poor. Eager to promote a delivery technology that augmented the public's programming choices, the FCC in 1979 suspended the mandatory license requirement for individual users' TVRO antennas and, in 1984, Congress included a provision in the Cable Act codifying the legality of individuals receiving satellite signals, even if not explicitly given permission by the owner, provided the signals were not encrypted and that the owner had not set up a method through which the signals could be purchased.[28]

The availability and increasing affordability of satellite dishes was particularly exciting to rural residents who suddenly were able to make a quantum leap in television reception and programs available to them. Today, out of approximately two million residential dishes in use, 1.2 million are in rural areas.[29] As this market developed, however, program owners became justifiably concerned with the resulting loss of revenue as their satellite-based distribution system enabled customers to receive programming without compensating the owner. A new marketing system was needed to distribute programming to this segment of the population.

A new system currently serving the market today involves the scrambling of satellite signals so that individuals not authorized to receive programming are not able to do so. In 1986, HBO was the first programmer to scramble its signals, and others quickly followed to the point where today over 40 programming services are scrambled. HBO's decision to employ a particular security and/or scrambling system known as the VideoCipher II was influential in establishing it as the de facto signal security standard since other programmers deciding to scramble did not want to burden customers with the expense of buying additional costly equipment that competing scrambling standards would have entailed.[illegible]

The VideoCipher system not only scrambles television signals but also addresses subscribers' individual units directly from a central location using digital technology. This makes the system flexible in terms of billing and new service additions, as well as giving programmers the opportunity to develop more fully pay per view optional programming. In addition, digital audio sound can be transmitted and, with the much anticipated arrival of high powered Ku-band satellite technology, full spectrum HDTV will be technically within reach of dish owners, who will also be able to receive satellite signals with much smaller (one meter diameter) dishes.

Scrambling initially led to market confusion as dish sales plummeted. The domestic earth station market is estimated to have fallen from $1 billion in 1986 to $700 million in 1987.[illegible] The perception among consumers was that programming and descrambling hardware would be expensive. One of the biggest draws of buying a satellite dish -- access to a broad range of diverse programming options -- seemed to have been destroyed.

A significant problem has been that of signal piracy. Pirates have discovered methods by which the electronic chips within a decoder can be altered or replaced to enable an individual to receive programs without authorization. Not only have programmers lost revenue, but the integrity of the whole marketplace was threatened as the piracy problem continued to grow. Suggestions of ways to combat the problem have ranged from stricter enforcement of present laws and prosecution of pirates to setting an FCC-mandated encryption standard.

New Technologies in Rural America

New telecommunications technologies have great potential to significantly affect rural America perhaps more than elsewhere considering the high cost and relatively low quality of long copper wire local telephone loops, the great distances over which terrestrial broadcast signals must travel, and the low penetration rates of cable video programming services typical in rural areas. New technologies have the potential to improve the quality not only of telecommunications services, but also of rural life in general.

Fiber optic technology was not designed with rural areas specifically in mind, but it is being employed there as well as in the national network, particularly in the interexchange market and in trunking applications. Fiber has the capability to carry extremely large volumes of traffic very efficiently. But, because the use of fiber is more cost-effective in high density areas, its use has been limited in lower density areas. However, its use has still found its way into rural systems, albeit 1.3 percent,[62] and as the price falls, is likely to penetrate further in portions of rural networks where relatively large volumes of traffic must be handled. Beyond basic telephone service, fiber also has the necessary bandwidth to support ISDN and other advanced applications. Thus, its use must be considered for future network planning in rural areas if they are to have the variety of telecommunications products and services that will be available over advanced networks elsewhere.

Some of the most promising research and product development is being done in developing new ways to utilize frequency to efficiently transmit information normally carried over wire, whether it be copper pairs, coaxial, or fiber. BETRS is one such service that uses radio frequencies to create local telephone loops between subscriber locations and central offices for individual subscribers who do not live in a franchised area, have no service available to them because of inhospitable geographic conditions, or are presently forced to use old, outdated equipment. It has been estimated that 900,000 subscribers face such conditions and could benefit from this technology.[33] Frequency allocation problems between BETRS and other users such as Public Land Mobile Service (PLMS) users have been addressed by the FCC, and BETRS service has been licensed to share frequencies with PLMS on a co-primary basis with minimal interference.[34]

A related technology just introduced on an experimental basis by International Mobile Machines Corporation (IMM) and Mountain Bell is a new digital radio carrier system being marketed under the name of "Ultraphone".[35] Ultraphone is intended to be used where rugged remote conditions, sparse population, and long cable lengths make improvements to existing phone service expensive. In the Ultraphone system, the subscriber uses a standard telephone connected to a radio transceiver that sends the voice signal from the phone to an antenna on the customer's premises. The signal may then be routed to other antennas, eventually reaching a microwave link that can relay the signal to the nearest central office where it can be routed into the public switched network. In addition, because the system is completely digital, it can be used for data transmission and could provide subscribers with the ability to take advantage of some future ISDN services. Even though the sophisticated digital multiplexing technology used would provide for extremely efficient spectrum utilization, a sufficient amount must be allocated by the FCC.

Another technology of great promise to the residents of rural America is the so-called Mobile Satellite Service (MSS). MSS allows geographically dispersed subscribers to be more economically aggregated in a network by replacing long wire land lines with radio frequencies transmitted via satellite accessible to rural telephone subscribers directly. Unlike Ultraphone, MSS has the additional capability of being available both to fixed and mobile users because of the large coverage "footprint" afforded by satellite communication and the frequencies which are assigned. Like Ultraphone or BETRS, MSS could provide rural subscribers with telephone service or upgrade existing party line connections. The radio channels could also be designed so that, in addition to voice service, medium speed data, facsimile service, teletype, telex, and other services could be provided.

Cellular radio telephone technology, already familiar to urban residents is about to be made available to rural communities as well. The technology involves radio frequencies transmitted to relay towers (cells) that employ sophisticated computer capability to pass the call off to another cell when the mobile customer leaves the area of coverage or, in the case of fixed subscribers to the nearest central office. Licenses are to be awarded to two providers in each RSA, one of which will be a local telephone company serving that area and the other a non-telephone company. Selections will be made on the basis of a lottery. Small local exchange carriers in many RSA's are banding together and filing joint applications so that resources can be pooled to aid in the application process as well as in arranging for the financing of construction and initial operations.

In the video programming area, Ku-band satellite transmission offers not only the prospect of smaller dish sizes but also the capability for a DBS system that would serve everyone with the necessary equipment. Satellites with Ku-band transponders are already in orbit and some receiving dishes have been developed. Still, because of economics, launch vehicle difficulties, and the existence of what may be a de-facto DBS system already in place, it is uncertain as to when this particular type of service will be available.

Conclusions

New telecommunications networks offer great potential for rural communities. This potential is the ability to "overcome the friction of rural space."[36] But there is yet another side that also needs to be recognized in future telecommunication policy debates: the potential for a widening gap between rural and urban areas in this country. It will become increasingly important for rural areas to be aware of their specific needs and how they can best be met. In an increasingly competitive environment, local exchange companies must be at the forefront of utilizing new technology in cost effective ways for the benefit of the service areas where they operate. If the market itself does not cause this to occur, then government at both the federal and state levels is likely to continue to play a significant role in the provision of services to rural areas.

Notes

1. The use of the term rural America throughout this paper recognizes the research conducted by L. Bender, et. al., "The Diverse Social and Economic Structure of Nonmetropolitan America," Rural Development Research Report 49, Economic Research Service, U.S. Department of Agriculture, September 1985.

2. The U.S. Bureau of Census divides the population of the nation on the basis of location. Persons who live in the country or in towns with a total population of less than 2,500 are said to be rural. For further discussion on the definition of rurality see Lloyd D. Bender, et. al., "The Diverse Social and Economic Structure of Nonmetropolitan America," and Everett M. Rogers. Social Change in Rural Societies. (Englewood Cliffs, NJ): Prentice Hall, 1988, p. 19.

3. The Rural Electrification Act of 1936 (7 U.S.C. 901-950b) was amended on October 28, 1969 to enable the Rural Electrification Administration (REA) to authorize loans for the purpose of furnishing and improving rural telephone service (63 Stat. 948; 7 U.S.C. 904). "A Brief History of the Rural Electric and Telephone Programs," United States Department of Agriculture, Rural Electrification Administration, March 1988.

4. Separations and settlements is a process by which costs are allocated between the interstate and intrastate jurisdictions. "Issues in Domestic Telecommunications: Directions For National Policy," NTIA Report 85-16, U.S. Department of Commerce, July 1985, p. 144.

5. Nationwide rate averaging had its roots in the 1940's. This rate structure permitted interstate calling between rural areas at no greater cost than for calling between densely populated areas for the same distance. See "Issues in Domestic Telecommunications: Directions for National Policy," NTIA Special Publication 85-16, U.S. Department of Commerce, July 1985, p. 144.

6. The Rural Electrification Administration (REA) is an agency of The U.S. Department of Agriculture which, among other things, provides financial assistance for rural electric and telephone organizations to provide service in rural areas. The REA was given statutory authorization by the Rural Electrification Act of 1936 and became part of the U.S. Department of Agriculture in July 1939. A detailed history and chronology of legislative changes is shown in A Brief History of the Rural Electric and Telephone Programs. (Washington, D.C.: U.S. Department of Agriculture, Rural Electrification Administration, March 1988), 1-5.

7. 85 Stat. 29; 7 U.S.C. 903, 922, 931, 932, 941 - 950b). For detailed chronology see A Brief History of the Rural Electric and Telephone Programs.

8. U.S. Department of Agriculture, A Brief History, 27.

9. Ibid., 29.

10. Ibid., 7.

11. Gerald S. Schrage, "Rural Subscriber Loop Performance," Telephone Engineer and Management, 15 January 1988, 75.

12. Ibid.

13. See table "Percent of Farms With Telephone Service" on p. 4 of this report.

14. Congress, U.S. House of Representatives, The Rural Electrification Administration Lending Assistance Improvement Act of 1988, 100th Cong., 2d sess., H.R. 5031, Congressional Record, daily ed. (14 July 1988), E2391.

15. U.S. Department of Commerce, The National Telecommunications and Information Administration, "Public Telecommunications Facilities Program; Final Rules." Federal Register (20 August 1987) vol. 52, no. 161, p. 31500.

16. U.S. Department of Commerce, The National Telecommunications and Information Administration, Office of Policy Coordination and Management, Report of Public Telecommunications Facilities Program, June 1988.

17. Petition for Rulemaking in CC-Docket 86-467. "Ammendment of Rules To Reduce the Administrative and Regulatory Burdens on Small Telephone Companies."

18. Notice of Proposed Rulemaking in CC Docket No. 86-495, 52 Fed. Reg. 04360, (1987). Report and Order in CC Docket No. 86-495, 53 Federal Register 12456 (1987).

19. As of July 1, 1988, eighteen applications were granted by the FCC to licensees for BETRS licenses. United States Telephone Association, Washington, D.C., July 1988.

20. The "Link Up America" telephone service connection assistance program was first implemented in October 1987. Thus far, 31 states and the District of Columbia participate in the FCC project. The program provides financial support for telephone service to eligible subscribers. Telecommunications Reports, June 27, 1988, p. 20. FCC reports indicate that after the first six months of the program, 13,995 low-income households were able to obtain

telephone service as a result of the program. See Telecommunications Reports, June 13, 1988, p. 26.

21. The Federal Universal Service Fund ensures that telephone rates are within the means of the average ratepayer in all areas of the country and provides assistance to companies operating in high cost areas. For further discussion see 96 FCC 2d 781 (1984).

22. In addition to the government organizations who assist with the rural telecommunications planning and development, the following trade organizations also assist in the area or rural telecommunications: The National Telephone Cooperative Association, (NTCA), the Organization for the Protection and Advancement of Small Telephone Companies (OPASTCO), the United States Telephone Association (USTA), the National Exchange Carrier Association (NECA), the Rural Telephone Finance Cooperative (RTFC), and the National Rural Telecommunications Association (NRTA). For further information see The Encyclopedia of Associations, 23 Edition, 1989. Detroit, MI: Gale Research, Inc., 1988.

23. An RSA, as defined by the FCC, is a county-based geographic delineation for the purpose of assigning cellular licenses in non-urban areas. There are now 428 RSA's for which the FCC will award both a non-wireline and a wireline authorization.

24. Ibid., 77.

25. Telecommunications Reports, June 13, 1988, p. 7.

26. Jan Lovell, "Network of Iowa Carriers Works Toward Equal Access." OPASTCO Roundtable, Summer 1988, p. 23.

27. Ibid.

28. Notice of Inquiry, 51 Federal Register 30267 (1986).

29. "Dishing Out TV in U.S. Outback,"Broadcasting, July 11, 1988, p. 66.

30. VideoCipher II is manufactured by General Instruments Corporation.

31. U.S. Department of Commerce, 1988 U.S. Industrial Outlook, January 1988, p. 31-4.

32. See "Composition of Rural Subscriber Loop Plant" on p. 6 of this report.

33. Data shows market demand for BETR technology encompasses all kinds of rural locations. Joint Comments of the BETR Petitioners, CC Docket No. 86-495, March 30, 1987.

34. *Id*., see also *Notice of Proposed Rulemaking*, 52 Federal Register 04360, (1987).

35. Mountain Bell's experiment with Ultraphone is in Glendo, Wyoming.

36. Don A. Dillman, "The Social Impacts of Information Technologies in Rural North America," *Rural Sociology* vol. 50, no. 1, (Spring 1985), p. 3.

Appendix A
Spectrum Management

The radio frequency (RF) spectrum, unlike other resources, is not consumed by use. When a particular use is completed, this resource may be used again for a similar or entirely different application. The radio frequency spectrum is a limited natural resource and, therefore, like other natural resources, its use should be conserved, and it should be judiciously managed. Technological progress over the years has permitted more and more users to satisfy their telecommunications requirements via the spectrum, very often sharing the same spectrum. On the other hand, tremendous strides have been made in non-spectrum areas such as fiber optics, thereby alleviating some spectrum demands.

When the spectrum is occupied by a particular user, use by others may be precluded because of interference. Since interference is a limiting factor in the use of the spectrum, it is important that all planning efforts take this factor into consideration. In general, sharing spectrum within a radio service or among radio services is only possible if harmful interference does not result.

New technologies that are introduced must also be examined from the standpoint of potential interference problems and treated appropriately to ensure electromagnetic compatibility (EMC) with the existing and planned environment. Because the spectrum is valuable for a variety of telecommunications applications affecting the well-being and economic health of the nation, the competition for its use has heightened. The demand for the use of specific radio services will undoubtedly continue to grow if use of such services is economical and allows for new or unique applications.

Since the spectrum is a shared resource nationally and internationally, absolute controls are limited by the actions of all spectrum users. The impact on U.S. spectrum use by the rest of the world's spectrum users has long been recognized and negotiated in the process of satisfying U.S. needs.[1]

International Spectrum Management

The International Telecommunication Union (ITU), a specialized agency of the United Nations, is a treaty organization that maintains an international structure enabling most worldwide telecommunications systems to operate in a reasonably efficient and orderly manner.

The Radio Regulations that result from the ITU conferences have treaty status and provide the principal guidelines for world telecommunications operations.

In the case of the U.S., they are the framework for development of the U.S. national frequency allocations and regulations. The Final Acts of the ITU conferences are usually ratified by the President upon receipt of the advice and consent of the U.S. Senate and achieve treaty status.

The U.S. is one of over 160 member nations of the ITU and has long recognized the importance of participating in international negotiations as necessary to achieving its telecommunications objectives. The U.S. is very active in the ITU and its four permanent organs (the General Secretariat, International Frequency Registration Board (IFRB), International Radio Consultative Committee (CCIR), and International Telegraph and Telephone Consultative Committee (CCITT)).

U.S. participation in the ITU is important because the ITU is a forum for the resolution of a broad range of foreign national and international spectrum management issues. These international spectrum negotiations relate to U.S. national and foreign policy, and are the responsibility of the Department of State, the National Telecommunications and Information Administration (NTIA), and the Federal Communications Commission (FCC).

For many years, the U.S. maintained a leadership role in telecommunications. This, coupled with the availability of spectrum to support most requirements and the lack of telecommunications development throughout much of the world in the past, allowed the U.S. to strongly influence the international spectrum management process. Today, this picture is different. One of the most significant ITU conferences in the post-world War II era was the World Administrative Radio Conference (WARC-79) that clearly showed the increased interest in telecommunications, particularly from developing countries, that placed uncertain broad future potential uses above immediate national needs. Portions of the spectrum have become highly congested, at least from an administrative perspective, and many decisions made during WARC-79 resulted in an increase of multiple service sharing. Several major frequency and orbital-satellite positioning issues were not resolved by WARC-79. These were deferred to future conferences that were held in the 1980's.[2],[3]

Domestic Spectrum Management

The foundations of present day radio frequency spectrum usage and management in the United States are based on the Communications Act of 1934. More specifically, the basic authority is delineated in Sections 303, 304, and 305 of the Act, with Section 303 presenting the general powers of the Federal Communications Commission regarding radio stations; 304 dealing with waiving frequency claims; and 305 providing that government owned stations shall be assigned frequencies by the President.

Section 305 is particularly significant because it provides for the demarcation between the Federal Government users and the non-Federal Government or private sector. Section 305:

> *Sec. 305. (a) Radio stations belonging to and operated by the United States shall not be subject to the provisions of sections 301 and 303 of this Act. All such Government stations shall use such frequencies as shall be assigned to each or to each class by the President.*

Section 305 has resulted in agreements between the Federal Government and non-Government sectors that divide the spectrum usage into three sectors: exclusive Federal Government use; exclusive non-Federal Government use; and shared use between the two sectors.

The Communications Act established the Federal Communications Commission and provided that it should administer the private sector. The President assigns frequencies to the Federal Government, although this duty is designated to another Federal Government agency via Executive Order.

Federal Government spectrum management is delegated by The President under Executive Order 12046 to the Department of Commerce, NTIA, which is aided by other federal departments and agencies through an advisory group, the Interdepartment Radio Advisory Committee (IRAC).

Although NTIA and FCC generally operate independently of one another, they exercise close coordination in spectrum matters. A liaison representative of the FCC sits with the IRAC, and NTIA participates in the rulemaking process of the FCC with the advice of the IRAC for spectrum matters and directly for other telecommunications matters.

FCC and NTIA have mutually coordinated frequency allocations that form the National Table of Frequency Allocations. Many portions of the spectrum are shared by both federal and nonfederal users; therefore, potential and actual interference between the two must be addressed and resolved. There are many competing radio services with increasing requirements, which must share the limited usable radio frequency spectrum. Therefore, allocation decisions are carefully coordinated and collected into the National Table of Frequency Allocations. As a result of these decisions, some bands are set aside for the exclusive use of the Federal Government and some for the exclusive use of the nonfederal sector. Most frequency bands are shared.[4] Long-range planning is necessary to meet the requirements of the competing radio services and users to accommodate them to the maximum extent possible.

The methods employed by NTIA and FCC in implementing their respective frequency assignment processes are largely dictated by the nature and number of the users involved. NTIA policies may have significant impact upon the design or cost or both of systems affected. Through NTIA's spectrum review process, major systems are reviewed at the planning, experimental, developmental, and procurement stages to ensure the availability of spectrum and the compatibility of the system with the environment, as well as to provide data for Federal long-range planning. Federal Government frequency assignment procedures are coordinated in the IRAC Frequency Assignment Subcommittee (FAS) where agency differences are resolved prior to final NTIA authorization.

The FCC confers nonfederal privileges for use of the spectrum and, as such, its decision-making processes are open to public participation and court review. Decisions establishing policy about permissible use of particular frequency bands are governed by the rulemaking requirements of the Administrative Procedures Act. Assignment decisions involving competing claims to the spectrum are decided by comparative hearings for broadcast channels or by lottery for low power TV or nonbroadcast channels. Uncontested spectrum assignments are handled routinely if consistent with the FCC's rules.

The assignment process consists of an application from the spectrum user and a construction permit or license from the FCC. The applicant is responsible for designing the system to be consistent with appropriate FCC rules, making any necessary budget or feasibility analyses, finding frequencies that can be used consistently with technical standards in the FCC's rules, and paying for the system.

These assignment processes are dependent on large automated data bases. These data bases serve different purposes for the two agencies and thus, are not entirely compatible. NTIA's data base is a record of spectrum use authorizations, and each entry constitutes an authorization to operate. This data base is also used for system EMC engineering. The FCC data base is a record of licenses which is used for EMC analysis also.

The Government Master File (GMF), the NTIA repository of Federal frequency assignment information and authority, contains approximately 220,000 assignment records as of January 1986. Each of the records may relate to the operation of a single station or the use of groups or classes of stations, such as several mobile or portable units. The number of authorized individual stations utilizing federal spectrum are estimated to be 1.5 million.

The FCC license files contain approximately 2.6 million frequency authorizations.[5] There are many mobile users that have multiple equipment authorizations. As in the case of the Federal Government, this means there are many individual users of the spectrum operating under one license.

Extensive data bases of FCC frequency assignment records are also maintained by private industry. Examples are the land mobile records maintained by the National Association of Business and Educational Radio (NABER) and the microwave radio relay and satellite earth station data maintained by Comsearch, Inc.

Spectrum Planning Factors. Inherent in the dual NTIA/FCC frequency allocation and assignment process are factors that bear on U.S. spectrum planning. The following are examples.

a. U.S. spectrum planning depends on the accuracy, completeness, and currency of the major data files used in spectrum management, especially the GMF and the FCC license record files.

b. Both NTIA and FCC engage in activities intended to assist in resolving pending and existing assignment and allocation problems. The federal systems review process deals with IRAC evaluation of frequency requirements early in a system's life cycle and, as such, provides guidance for spectrum planning. The FCC addresses similar issues in its rulemaking process and with the assistance of ad hoc groups for specific planning areas.

c. Frequency assignments are granted with the understanding that only limited rights are established with assigned frequencies, and assignments can be revoked or not renewed. However, the regulating bodies recognize the investment users have in their systems, and once assignments are made, they tend to be protected against other potential spectrum users.

Federal Government Spectrum Management (NTIA)

NTIA is the organization within the Department of Commerce that manages use of the RF spectrum by agencies of the Federal Government. The principal spectrum management functions are: (1) to provide frequency assignments to Federal Government agencies; (2) to develop plans and policies for the effective and efficient use of the spectrum in coordination with the FCC; (3) to undertake substantive preparation for ITU radio conferences on behalf of the Executive Branch including pertinent foreign counterpart consultation, presentation of coordinated Executive branch views on telecommunications matters, and promoting international cooperation regarding telecommunications-related policy matters.

Office of Spectrum Management (OSM). NTIA manages the Federal Government's use of the spectrum through its Office of Spectrum Management (OSM). A high degree of cooperation between FCC and NTIA is required, since a majority of the spectrum is shared between Federal and nonfederal users. OSM's mission is to: (1) satisfy the Federal Government's present and future spectrum needs, both national and international, and (2) ensure that Federal spectrum use is efficient and effective, while maintaining a balance between the Federal Government and other interests. OSM coordinates with Federal departments and agencies so that their statutory spectrum dependent functions are considered.

OSM employs a number of spectrum planning methods. The analytical studies of various frequency bands and services, known as spectrum resource assessments (SRA's), provide a body of knowledge and information for long-range planning. Future trends and potential problem areas are identified enabling NTIA to take the appropriate corrective actions before major spectrum problems develop.

OSM has recently developed a new and innovative approach to analyzing the use of the radio spectrum. The Spectrum Use Measure (SUM) joins the technical properties of the radio spectrum to the geographical dimension in a manner that allows for the quantification, measurement, and graphic display of how the nation's spectrum resource is utilized. The SUM provides new approaches to spectrum management and promotes more efficient and effective use of the radio spectrum.[6]

The NTIA Manual. The Manual of Regulations and Procedures for Federal Radio Frequency Management[7] (NTIA Manual) is developed by the OSM with the advice of the Federal Government agencies and is issued by the Assistant Secretary of Commerce for Communications and Information. The NTIA Manual contains the frequency management procedures and structure, the allocation and assignment of spectrum, technical standards, and the international spectrum management procedures. Overall, the NTIA Manual documents a dynamic and flexible process which enables the federal agencies to continually satisfy new and changing telecommunications requirements nationally and internationally.

The System Review Process. The systems review process requires that proposed uses of the spectrum take into consideration each existing and planned use to ensure that unacceptable interference will not be caused or received by the new users. NTIA requires each federal agency that plans to develop or procure a new major communications-electronics system to provide detailed technical, functional, and deployment information to NTIA for review before the agency commits funds for the system. This information is reviewed by the Spectrum Planning Subcommittee (SPS) of the IRAC to ensure that the intended use conforms with international and national radio regulations and that the system can be expected to operate compatibly with other systems in the proposed frequency band. These reviews are conducted through all phases of a system's development.

If the SPS review is favorable, NTIA may certify spectrum support for the system and permit the federal agency to proceed to develop or procure the system. If the review is unfavorable, NTIA may either deny spectrum support or provide suggestions whereby the system may be accommodated in the spectrum. This procedure helps to ensure that funds are not expended for systems that cannot be supported within the spectrum. This process also serves to inform federal agencies, including the FCC, of federal plans for spectrum-using systems. NTIA guidance provides an early warning to new systems designers of environmental factors that may inhibit the use of new systems and guidance as to the direction the applicant should take to obtain spectrum support.

Federal Government Frequency Assignments. The frequency assignment process ensures that individual frequency assignment requests are investigated so that users do not cause interference to or receive harmful interference to or from other users. Specific authority must be obtained from NTIA for all Federal Government RF spectrum uses.

The IRAC. The IRAC has been in existence since 1922 and currently consists of representatives from the 20 major Federal Government spectrum users of plus a liaison representative from the FCC. The IRAC meets twice a month and gives advice and assistance to the Administrator of NTIA in all areas related to spectrum management. The IRAC is chaired by, and reports directly to, the Deputy Associate Administrator, OSM. Federal representatives to the IRAC collectively provide extensive expertise regarding the use of the spectrum in all radio services.[8]

The IRAC provides a forum for knowledgeable discussion of the problems associated with spectrum management and a means for developing recommendations. The IRAC is primarily concerned with federal spectrum use; however, the FCC liaison representative provides comments on behalf of nonfederal government agencies and the public. The IRAC and its subcommittees supply the primary means for coordination between federal and nonfederal spectrum users. The subcommittees also have FCC liaison representation. The three standing IRAC subcommittees are: the FAS, the SPS, and the Technical Subcommittee (TSC). U.S. international frequency notification matters are handled by the IRAC's International Notification Group (ING).

Frequency Management Advisory Council (FMAC). The FMAC was established in July 1965 under the provisions of the Federal Advisory Committee Act. The FMAC consists of 15 members appointed by the Assistant Secretary of Commerce for Communications and Information (Administrator NTIA) and reports

---

to the Secretary of Commerce through the Assistant Secretary. The FMAC is chaired by the Associate Administrator of OSM and normally meets three times a year.

The FMAC provides advice on RF spectrum allocation and assignment matters and the means by which the effectiveness of federal frequency management may be enhanced. The members represent a balance of expertise in such areas as manufacturing, analysis and planning, telecommunications operations, research, academic/social affairs, and international negotiations.

FMAC members are selected for their expertise in existing or planned communications and electronic systems, research leading to new technology, communications systems operations, spectrum regulation and management, and domestic and international telecommunications law and treaties. Specifically, the council draws on the expertise of its members to: (1) review spectrum management programs; (2) review the progress of EMC programs; and (3) develop proposed United States positions on spectrum issues before ITU conferences.

NTIA utilizes the FMAC to obtain advice on major spectrum management issues, such as frequency support for the proposed U.S. space station, commercialization of space, consideration of the environmental effects of RF radiation in the spectrum management process, and the implementation of new spectrum conserving technology.

Private Sector Spectrum Management (The FCC)[9]. The FCC is responsible for spectrum management in the private sector consisting of private industry and state and local government.

Organizationally, the FCC is comprised of five Commissioners who are appointed by the President, with the advice and consent of the Senate, for overlapping terms of five years. No more than three may be from the same political party and one is appointed Chairman. Congressional control is exercised through subcommittees of the U.S. Senate and the House of Representatives.

Spectrum management is handled in several different ways by the FCC. Frequency assignments are considered in the operating bureaus -- Mass Media, Private Radio, and Common Carrier. The Field Operations Bureau operates monitoring stations and field offices. The Office of Engineering and Technology (OET) has a research and standards division responsible for developing technical standards for radio equipment, and for performing analytic studies of the spectrum and the services using it. The OET operates a Laboratory Division conducting studies of new technology and equipment, and is responsible for the equipment authorization program.

The FCC's approach to spectrum management varies, covering a broad range of techniques from carefully engineered and protected frequency assignments (such as broadcasting of communications satellites) to citizens' band where literally hundreds of unlicensed users operate in a given locale. Overall, the FCC provides for 69 different services.

There are differences in approach taken by the various operating or licensing bureaus. The FCC follows the "block allocation" method allocating spectrum to particular classes of services and placing the responsibility to the particular bureau.

Although rules governing each of the services are promulgated in ten volumes which are generally administered by the operating bureaus, they have their frequency genesis in Part 2 Volume II which contains the National Table of Frequency Allocations and which is administered by the Office of Engineering and Technology.

The FCC has given official status to private coordinating groups in the land mobile services. These groups select frequencies and coordinate them with other users in the frequency band. The selected frequency is then submitted to the FCC for licensing.

The FCC uses Federal Government advisory committees to provide expert advice on a number of matters as required. For example, the FCC usually establishes an advisory committee to advise it when preparing for a major conference of the ITU. The FCC has also created an advisory committee to provide advice and recommendations on High Definition Television (HDTV).

Notes

1. For additional information on the radio spectrum, refer to Spectrum Management and Engineering, edited by F. Matos and published by IEEE Press. It consists of reprints of 51 papers on various aspects of domestic and international spectrum management and engineering plus additional material on legal and regulatory matters, and management tools and methods.

2. "The United States Relationship with the International Telecommunication Union," prepared by IRAC Ad Hoc 187 for the NTIA, IRAC Doc. 25375/2 1.9.187/3.1.33, March 1987.

3. "Long Range Goals in International Telecommunications and Information," Committee Print 98-22, U.S. Senate, Committee on Commerce, Science and Transportation, Mar. 11, 1983.

4. Because the communications capacity of different frequencies varies considerably for reasons of technology and physics, the precise amount of available spectrum in each category is hard to quantify in a meaningful way. However, based simply on the number of Hertz allocated to each category in the developed region of the spectrum (between 9 kHz and 40 GHz), about 6.1% is allocated exclusively for Federal Government use, about 31.4% for nonfederal use, and about 62.5% for shared use. Most of the spectrum above 40 GHz has been allocated on a shared basis. The entire range of spectrum, as allocated in the U.S. (9 kHz - 300 GHz), is allocated as Federal Government 1.6%, nonfederal 12%, and shared 86.4%.

5. "51st Annual Report/Fiscal Year 1985," Federal Communications Commission, Washington, DC.

6. "The SUM Data Base: A New Measure of Spectrum Use," R.J. Mayher, et al., NTIA Report 88-236, NTIA, Washington, DC, August 1988.

7. "Manual of Regulations and Procedures for Federal Radio Frequency Management," Dept. of Commerce, National Telecommunications and Information Administration, Washington, DC, updated annually.

8. "IRAC Semiannual Report," issued semiannually by the IRAC Secretariat, NTIA, Washington, DC.

9. This section relies heavily on "United States National Spectrum Management," L.A. Buss and R.L. Cutts, Telecommunication Journal, vol. 47, pp. 320-334, June 1980. (Reprinted in the book discussed in Reference 1)

Appendix B

Telecommunications Standards

Technological developments, marketplace forces, deregulation, the AT&T divestiture, and the ensuing competition have hastened the application of computer technology in the U.S. telecommunications industry, and that is producing an impressive array of new telecommunications products and services. Unfortunately, the same industry changes have substantially complicated standardization, and network planning and integration, and diffused responsibility for their accomplishment among many independent and often competing organizations. This has made it difficult to fully realize the potential benefits the new products and services offer.

For U.S. telecommunications providers, the challenge is to plan and implement efficient multi-vendor networks in a competitive market environment. For users, the challenge is to make cost-effective choices among a growing array of competing equipment and service alternatives. A similar trend towards competitive market conditions, and a similar set of challenges, are emerging in other countries - and increasingly, in international telecommunications as well.

A key to meeting these challenges is the development of cooperative forums in which multi-vendor networks and new service concepts can be efficiently planned and uniformly described. In the U.S., new industry standards organizations, such as the ANSI-Accredited T1 Standards Committee, have evolved to fulfill this need. Similar cooperative planning forums are emerging in other countries and regions -- and international standards bodies such as the International Telegraph and Telephone Consultative Committee (CCITT) and the International Organization for Standardization (ISO) have greatly increased their involvement in cooperative planning activities.

CCITT's effort to develop comprehensive technical standards for a global Integrated Services Digital Network (ISDN) and ISO's effort to achieve world-wide interoperability among computer systems through the development of Open Systems Interconnection (OSI) standards are examples of such international planning efforts.

The technical standards developed in these national and international planning forums strongly impact both the effectiveness of the U.S. telecommunications infrastructure and the viability of U.S. telecommunications products and services in international markets.

Telecommunication standards development is largely an industry responsibility in the U.S., but a properly-focused Federal involvement is essential for two reasons:

- To ensure that unique Federal telecommunication requirements (relating, for example, to national security and emergency preparedness) are adequately addressed in industry network plans.

- To ensure that the industry-developed standards include performance standards that may be used by Federal agencies (and industry users) to objectively assess the quality of competing equipment and service alternatives.

Experience has shown that in specific cases, Federal participants can also enhance the effectiveness of industry standards forums by providing impartial, expert mediation among competing industry organizations; and by providing specialized technology not readily available from industry participants. The following paragraphs describe selected U.S. and international standards organizations and summarize NTIA's current involvement in national and international standards development work.

U.S. Standards Organizations

Two U.S. standards organizations are of major importance in the development of domestic standards in the telecommunications and information processing industries: the American National Standards Institute (ANSI) Accredited Standards Committees (ASCs) X3 and T1. A third U.S. standards committee, the United States Organization for the CCITT (U.S. CCITT), plays an important role in coordinating U.S. participation in the international standards work of the CCITT. The Electronic Industries Association (EIA) and the Institute of Electrical and Electronics Engineers (IEEE) are also involved in standards activities with a primarily domestic focus.

ANSI is a nonprofit organization that coordinates voluntary standards activities in the United States. It is governed by a Board of Directors representing all the interests cooperating within the voluntary standards system. Several councils, boards, and committees carry out ANSI programs with the support of a staff of 100. Present ANSI membership consists of approximately 220 nonprofit organizational members (standards organizations, trade associations, Federal and state governmental bodies, professional groups, etc.) and almost 1,000 large and small company members, representing virtually every facet of commerce, trade, and industry.

ANSI has two primary functions. First, ANSI coordinates private sector activities in the development of national standards and decides on the eligibility of standards to be called American National Standards. Second, ANSI manages, coordinates, and provides financial and administrative support for U.S. participation in nongovernment international standards bodies. ANSI is the official U.S. member of two such bodies, ISO and IEC. Other ANSI activities include serving as a clearinghouse of information on all American National Standards, standards promulgated by ISO and IEC, and standards promulgated by the national standards organizations in other countries that cooperate within ISO.

Accredited Standards Committee X3. The present ASC X3 evolved from a 1980 merger of the original American National Standards Committee (ANSC) X3, "Information Systems" (1961), and ANSC X4, "Office Machines" (1961). The secretariat for X3 is the Computer and Business Equipment Manufacturers Association (CBEMA). The scope of X3 covers standardization in the areas of computers, information processing, peripheral equipment, and the related devices and media; and standardization of the functional characteristics of office machines and accessories for such machines, particularly in those areas that influence their operation. The title of X3 was changed from "Information Systems" to "Information Processing Systems" in 1982.

Accredited Standards Committee T1. ASC T1 develops standards and technical reports related to interfaces for U.S. networks which form part of the North American telecommunications system. T1 also develops positions on related subjects under consideration in various international standards bodies. The secretariat for T1 is the Exchange Carriers Standards Association (ECSA). T1 standardization efforts are focused on the interconnection and interoperability of telecommunications networks at interfaces with end user systems, carriers, and information and enhanced service providers. Topics of particular interest include switching, signaling, transmission, performance, operation, administration, and maintenance. Committee T1 is also concerned with procedural matters at points of interconnections, such as maintenance and provisioning methods and documentation, for which standardization would benefit the telecommunications industry.

Electronics Industries Association (EIA). The Electronic Industries Association (EIA) is a trade association for U.S. manufacturers of electronic equipment and components. It has a membership of 1200 companies and is based in Washington, D.C. EIA has long been a standards provider in electronics, and has become more involved in telecommunications and fiber optics in the last several years. EIA is an ANSI-accredited standards development organization. EIA standards activities are open to any interested party. Standards developed by EIA working groups may be submitted to ANSI as proposed American National Standards. The EIA catalog lists over 450 active EIA standards.

IEEE Standards. The Institute of Electrical and Electronics Engineers (IEEE) is a professional engineering organization with a membership of about 293,000 individual technical experts. It is a major source of standards in electronics and computers. Like EIA, the IEEE is an ANSI-accredited standards development organization. IEEE-developed standards may be published by the IEEE or may be submitted to ANSI as proposed American National Standard. IEEE has over 530 currently active standards with about 45 new and revised standards published yearly.

U.S. CCITT Activities. The participation of the United States in the work of the CCITT is channeled through the United States Organization for the CCITT (commonly referred to as the "U.S. CCITT"). This national organization, headed by the Office of International Communications of the U.S. Department of State, exists primarily to assist and advise the Department of State on matters concerning U.S. participation in CCITT affairs. Membership in a U.S. CCITT study group is open to interested parties and does not require membership in the CCITT.

The U.S. CCITT promotes interests of the United States in CCITT activities; provides advice on matters of policy and positions in preparation for CCITT plenary assemblies and meetings of the international CCITT study groups; provides advice on the disposition of proposed contributions to the international CCITT; and assists in the resolution of administrative/procedural problems pertaining to the United States CCITT activities. The U.S. CCITT serves also as the pool of informed public and private sector personnel that can be drawn upon to staff U.S. delegations to the international study group meetings and plenary assemblies.

International Standards Organizations

Three international organizations are of major importance in establishing technical standards for the telecommunications and information industries: ISO, IEC, and CCITT. A number of European standards organizations, with international but regional responsibilities, also play a significant role: CEPT, SPAG, ETSI, CEN, CENELEC, ECMA, and EWOS.

International Organization for Standardization (ISO). The ISO is a nontreaty, voluntary international organization of 89 member nations. Founded in 1946, ISO continues the work started in 1926 by the International Federation of National Standardization Associations (ISA). The ISO develops, coordinates, and promulgates international standards (over 5,000 to date) that facilitate world trade, contribute to the safety and health of the public, and help protect the environment. ISO standards cover almost all fields except electrical and electronic engineering (work of the IEC). The corollary objective of ISO is to develop worldwide cooperation in the sphere of intellectual, scientific, technological, and economic activity.

Although ISO is a nongovernmental organization, more than 70% of the ISO member bodies are governmental standards institutions or organizations incorporated by public law. Most of the remainder have close links with the public administrations in their own countries. However, reflecting the voluntary nature of U.S. standards, the U.S. member body is ANSI.

Technical Committee (TC) 97 is an example of a large, high-technology ISO Technical Committee and is the ISO TC most directly involved in telecommunications. It is unique among ISO committees because of its rapid growth field. The scope of TC 97 is Standardization, including terminology, in the area of information processing systems, including personal computers and office equipment. Most of the international standards work on Open Systems Interconnection is centered in TC 97.

International Electrotechnical Commission (IEC). The IEC is, like ISO, a nontreaty, voluntary international standards organization. The IEC was formed in 1904. The founders united to prevent the kind of divergence in national electrical standards that had already resulted in European nations operating electrical systems at 220 V while North American nations operated them at 115 V.

The standardization work of IEC includes topics such as universal technical language for definitions, electrical and electronic symbols, and electrical units; test methods; system characteristics such as voltages, frequencies, and tolerances; dimensional requirements and tolerances of electrical and electronic components and equipment; and universal electrical safety requirements of all kinds. The operational structure of IEC somewhat resembles that of the ISO. The United States is represented in IEC by the U.S. National Committee (USNC), established in 1907, which is part of ANSI.

In 1987, a very unusual joint venture was enacted between ISO and IEC. A joint technical committee was formed, ISO/IEC JTC1, "Information Technology". This merger combined the premier international information technology standards committee, ISO TC97, with two relevant IEC committees.

International Telegraph and Telephone Committee (CCITT). The CCITT is a permanent study committee within the 123-year old International Telecommunication Union (ITU), a specialized Agency of the United Nations. The ITU, through the work of its 157 member nations (governments), has responsibility for regulating, planning, coordinating, and standardizing international telecommunications of all kinds worldwide.

In contrast to the ISO and IEC, whose basic purpose in each case is the development of international standards, the ITU has several purposes, only one of which is the establishment of telecommunication standards (called "Recommendations" by the CCITT). The European members of the CCITT are the individual country telecommunication Administrations, or PTTs. The U.S. member of the ITU, and necessarily of the CCITT, is the U.S. Department of State. The U.S. national standards committee most involved with CCITT matters is the ANSI-Accredited Standards Committee T1.

European Conference of Postal and Telecommunications Administrations (CEPT). CEPT was founded in 1959 and now has members from 26 countries. This powerful "consortium" of CCITT members has two special commissions, the Postal Commission and the Telecommunications Commission. It is a mechanism for coordinating the post and telecommunications policies of European governments, and promulgating European recommendations. CEPT's influence is illustrated by the work done by its Special Group on ISDN in the early 80s. The group became a means of coordinating plans and strategies on ISDN, developing common contributions for submission and support within the CCITT.

Standards Promotion and Application Groups (SPAG). The Standards Promotion and Application Group (SPAG), originally composed of 12 leading manufacturers of information technology (IT) products, was founded in March 1983 at the request of the Commission of the European Communities (CEC). The CEC's initial objective was to receive guidance from SPAG in the promulgation of a European Information Technology Standards Policy for providing a homogeneous and wider European market for IT products.

The resultant European policy (which is also followed by the European Free Trade Association, EFTA) has targeted OSI implementation as the basis for public procurement for 17 European countries. According to this plan, all member countries will eventually adopt Functional Standards published as "European Standards" (ENs) which in the ideal and stable case "shall be implemented nationally by the publication of a National standard identical in presentation and context". The targeted year for a single, open, competitive European market is 1992.

The goal of this effort is the elimination of differences among European national information technology (IT) standards, thereby eliminating technical barriers to commerce in IT and data communication products in European markets. To assist in the achievement of this policy, the major joint European standards institutions (CEN and CENELEC) in cooperation with CEPT, formed a joint Information Technology Steering Committee (ITSTC). A major input to this process has been the extensive compilation of profiles developed by the SPAG Technical Committee and Expert Groups and published in the "Guide to the Use of Standards" (GUS) from which the European Functional Standards have been developed and published as "European Pre-Standards" (ENVs).

European Telecommunication Standards Institute (ETSI). In March 1988, CEPT established the European Telecommunications Standards Institute, ETSI, to handle European Telecommunication Standards, NETS. The new program of European standards has been developed to permit the development of a truly open European market in telecommunications terminal equipment. The NETs contain the common compliance specification which this type of equipment is required to satisfy to obtain authorization for connection to European public telecommunications networks. Where appropriate, they also include radio provisions.

The operators of public networks are required to make reference to relevant NETs in public supply contracts. The majority of NETs fall into 2 categories: access and terminal. For both types of NETs the requirement is for a content which is the minimum to achieve the stated objectives. Voluntary standards which may include end-to-end compatibility, and product standards may then complement the NETs. These voluntary standards in the form of CEPT Recommendations are created in the traditional way.

The existence of a NET will make it possible for the competent authority in a country whose Administration has signed the CEPT Memorandum of Understanding on European Telecommunications Standards to issue a certificate of conformity based on a test report from an accredited lab after carrying out the tests specified in the NETs. This certificate is then recognized as valid in all other Signatories' countries.

Comite European de Normalisation (CEN). CEN, formed in 1971, is the European equivalent of ISO formed to encourage free trade of goods and services in Europe through the use of standards. In effect, CEN attempts to lower non-tariff trade barriers that the European nations have erected with their national standards (the goal of the CEN aimed at 1992). CEN is governed by a General Assembly and operates in a manner similar to ISO. Its influence in the area of IT standards is growing as the merger of IT and telecommunications grows and the PTTs, through their national governments, assert their influence.

Comite European de Normalisation Electrotechnique (CENELEC) CENELEC is the European equivalent of IEC, concerning itself with electrotechnical matters, and has the same purpose as CEN, the lowering of trade barriers in the European community. Joint CEN/CENELEC activity is expanded as Europe gears up for 1992.

European Computer Manufacturers' Association (ECMA). ECMA was formed in 1961 to coordinate the work of making various computer standards compatible. This association has as ordinary members "the companies which in Europe develop, manufacture, and market data processing machines used to process digital information for business, scientific, control, or other purposes." Members are not obliged to follow any ECMA standards. ECMA is a very active liaison member of both CCITT and ISO.

European Workshop on Open Systems (EWOS). In 1987, eight European associations that work to define the requirements for IT equipment formed the European Workshop on Open Systems (EWOS). The nine groups sponsoring EWOS include CEN, CENELEC, CEC, ECMA, and SPAG. EWOS is defined as "a platform on which all relevant organizations such as users, vendors, PTTs, standardization bodies, and academia can meet and agree on the policy and detailed definitions covering true market needs." Its key objective is to provide a focal point in Europe for the study and development of the technical contents of OSI profiles and corresponding test specifications.

NTIA Standards Development Activities

The National Telecommunications and Information Administration's Institute for Telecommunication Sciences (ITS) has been involved in the development of national and international telecommunication standards designed for use in a competitive environment since well before the divestiture, and has contributed to leadership and technical support within Committee T1, Committee X3, the U.S. CCITT, and the CCITT over a period of several years. ITS currently provides the Chairmanship of T1 Subcommittee T1S1. That Subcommittee is the largest within T1, and has an important responsibility in planning the cooperative implementation of ISDNs.

Under the auspices of the Department of State, ITS also heads the U.S. CCITT Joint Working Party on ISDN and leads the U.S. Delegations to international meetings of CCITT Study Group XVIII (Digital Services and ISDNs). Institute staff members provide leadership and technical support within Subcommittee X3S3 (Data Communications) and Subcommittee T1Q1 (Telecommunication Performance). Under ITS leadership, Task X3S3.5 has developed two American National Standards--X3.102 and X3.141--which collectively specify user-oriented, technology-independent performance parameters and measurement methods for data communication services.

The ITS work in T1Q1 is focused on development of functionally-oriented performance standards for digital services and ISDNs - and more recently, on research aimed at developing user-oriented, technology-independent performance

2.6 10

standards for future digital voice communication services. This ITS work i particularly relevant to the post-divestiture needs for better system integration an service selection tools.

The Institute has also been involved for several years in direct leadership o international standards development within CCITT. ITS work has been focused o the development of international data communication performance standards i Study Group VII (Data Communication Networks). That work has resulted i CCITT approval of a new Recommendation, X.140, that defines user- oriented network-independent Quality of Service parameters similar to those specified i American National Standard X3.102. More recently, a set of four new CCIT Recommendations which specialize the Recommendation X.140 parameters fo application to packet-switched public data networks has been completed.

Early in the 1985-1988 CCITT Study Period, NTIA/ITS representative presented a contribution to CCITT Study Group XVIII proposing a overal framework for the development of ISDN performance standards. In essence, tha framework is identical to the framework specified in American National Standar X3.102 and later adopted in CCITT Study Group VII. The framework was adopted by CCITT Study Group XVIII, and the development of ISDN performance standards within CCITT is now being conducted in accordance with it.

Compatibility between the CCITT Study Groups VII and Study Group XVIII parameter development frameworks will do much to ensure compatibility among the performance standards developed in those two groups. That in turn should facilitate the development and interconnection of ISDNs in the U.S. and elsewhere. Several general Recommendations defining ISDN performance parameters based on the X.140 framework were completed during the 1985-1988 CCITT Study Period. Related American National Standards are under development.

9642

☆ U.S. GOVERNMENT PRINTING OFFICE: 1988— 2 2 3 - 8 6 4 /9 0 2 7 2 7

MAR 29 1990

MAR 29 1990

DATE DUE

[illegible]

BRODART, INC.

Cat. No. 23-221

WERT
BOOKBINDING